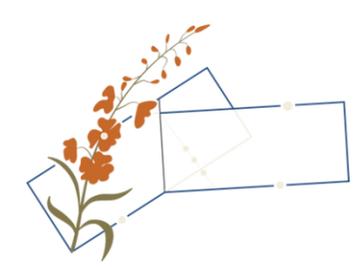


TEBUGHNA FIREWEED

2023 Design Challenge
Division: New Housing





MEET OUR TEAM



Sophie
Abel



Addison
Besedic



Sydney
Cherrington
Student Lead



Joshua
Clark



Hannah
Concepcion



Kaley
Denaro



Abigail
Duffey



Hayley
Gillette



Garrett
Gruttadauria



Caitlin
Jennings



Mahtab Kouhi
Rostamkolaei
Constr Mgmt



Frank
LaPuma



Valeria Lobo
Colmenares



Juan
Miri



Erica
Morrissey



Joyce
Ng



Thomas
Slay



Courtney
Smith



Benjamin
Spears



Mark
McGlothlin
Faculty
Architecture



Robert
Ries, PhD
Faculty
Constr Mgmt



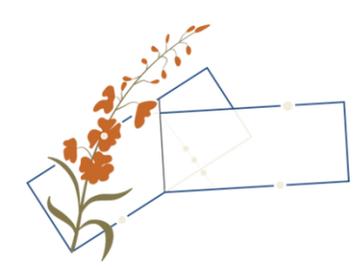
Bradley
Walters
Faculty
Architecture

Design Partners:

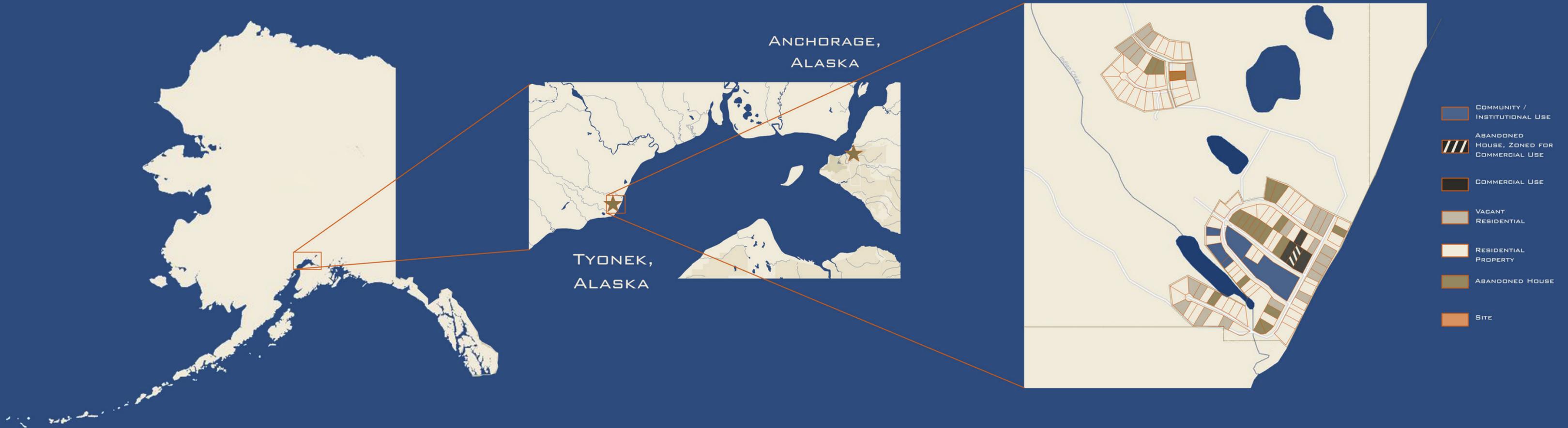


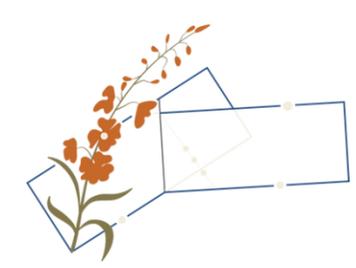
Industry Partners:





TYONEK, ALASKA





THE TEBUGHNA PEOPLE

WHO ARE THE BEACH PEOPLE?



FIREWEED: RESILIENT AND TENACIOUS





OUR MISSION

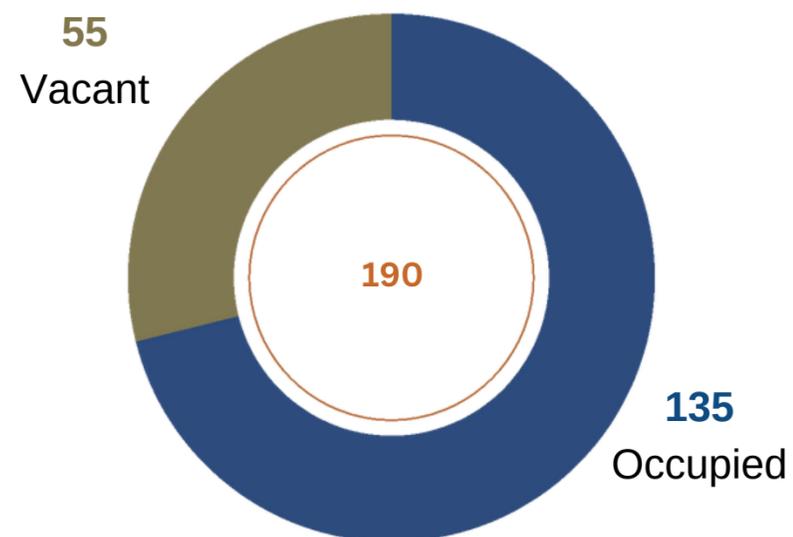
Design and prepare future-ready homes for the people of Tyonek, AK to exhibit how high performance low carbon buildings are attainable and affordable in cold climates. The design of the home is intertwined with Athabascan values of environmental justice and respect for their traditions as well as Alaska's climate.



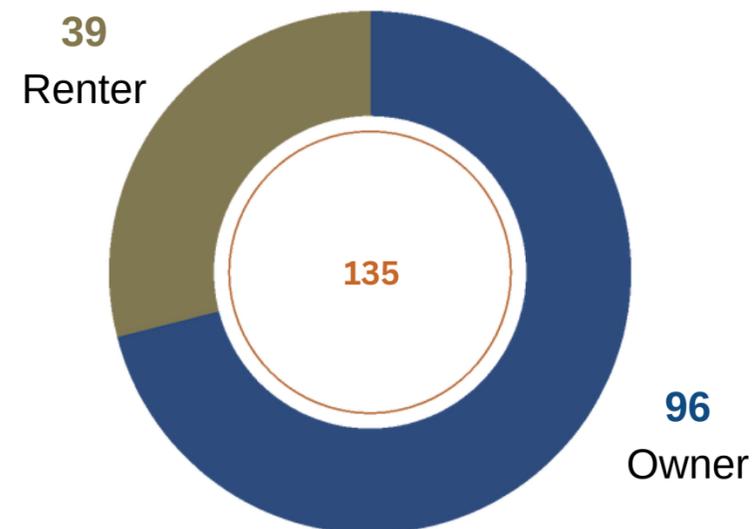
TYONEK TODAY



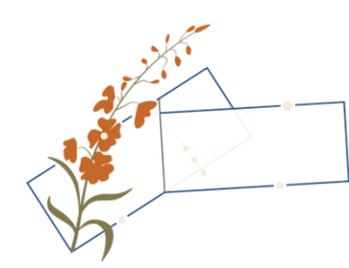
Occupied vs. Vacant Units



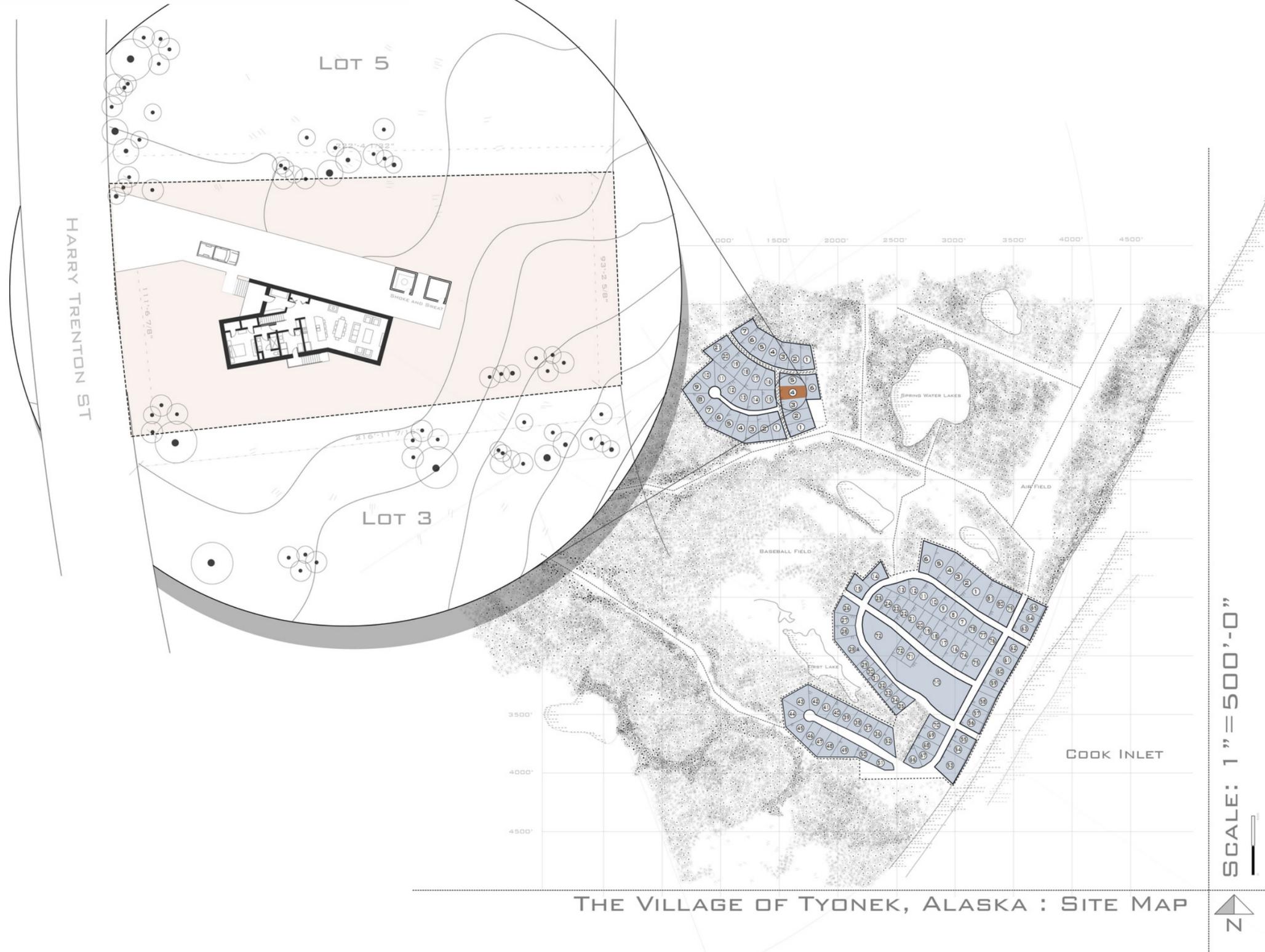
Ownership of Occupied Units

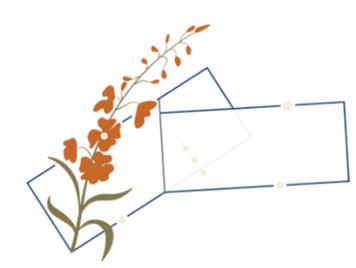


- **Village population decrease in past 3 years:**
 - Lack of economic opportunities
 - Lack of access to decent housing



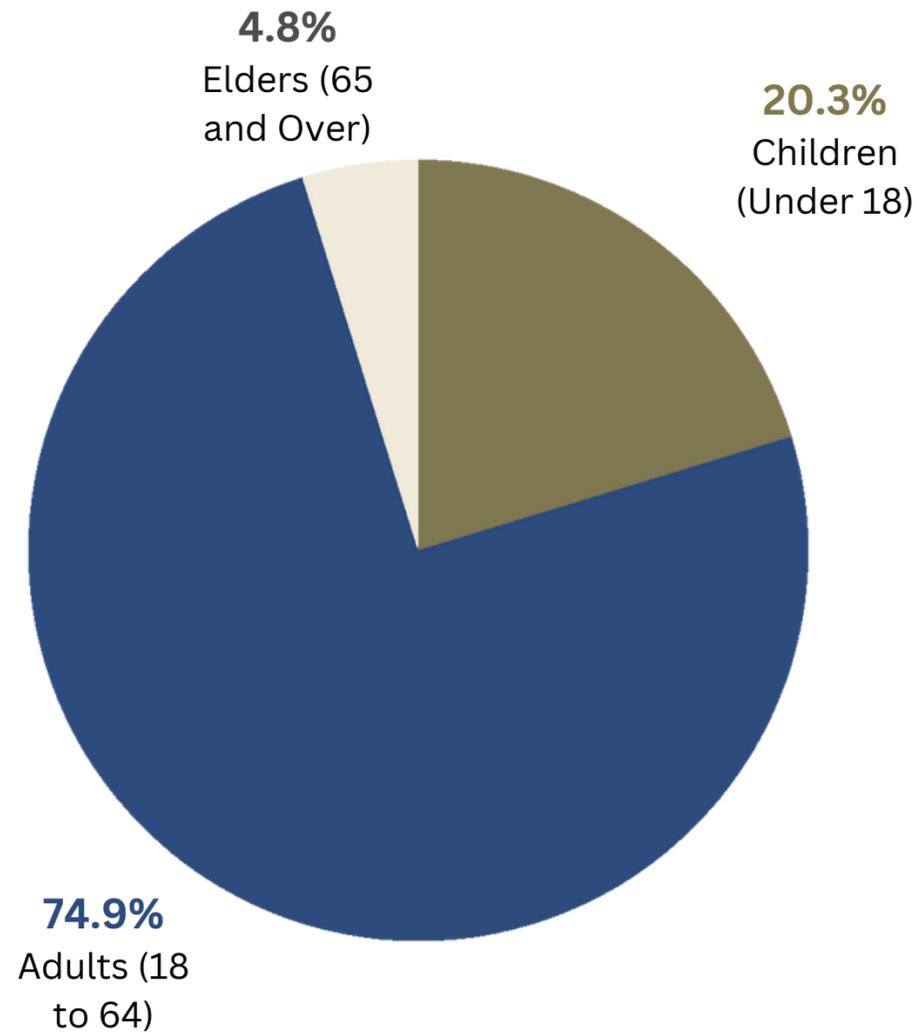
CONTEXT MAP



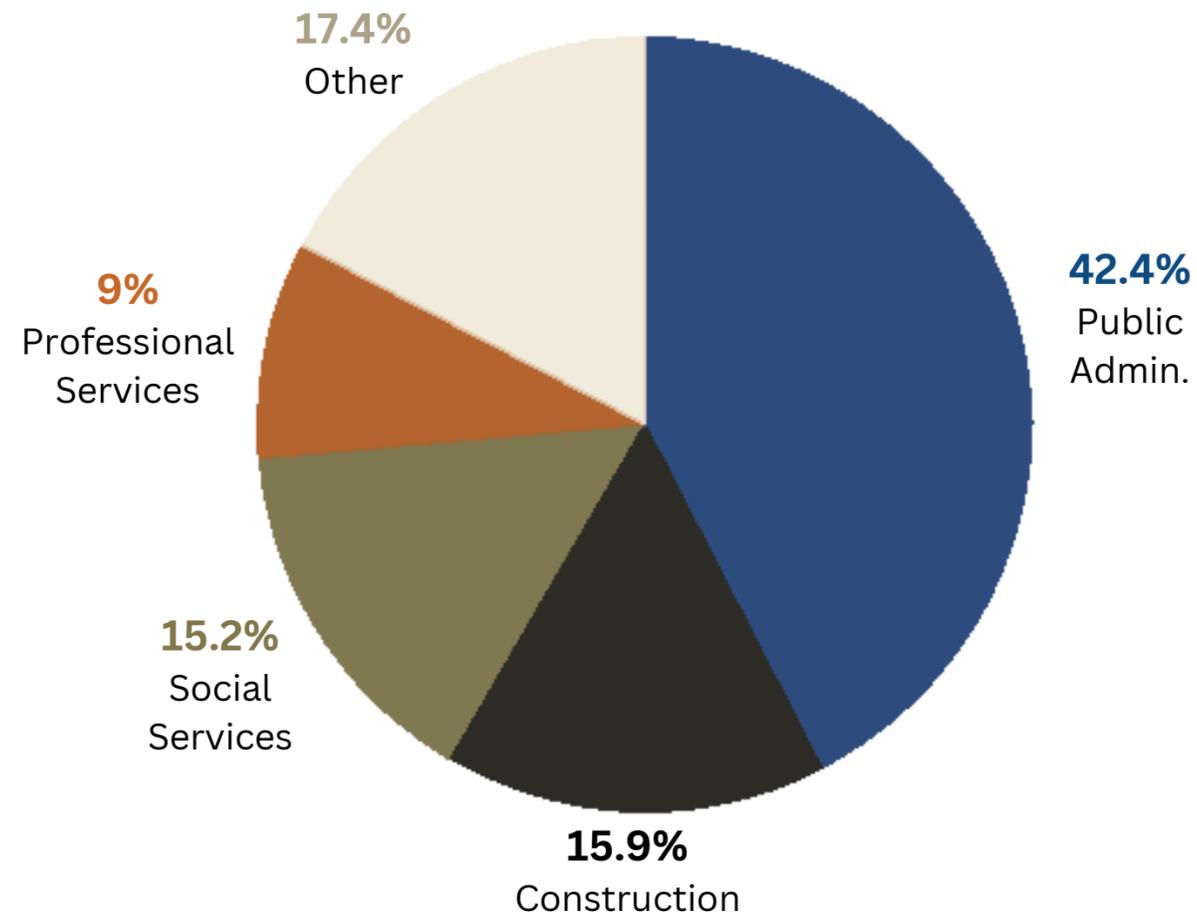


DEMOGRAPHICS

Population Age by Category



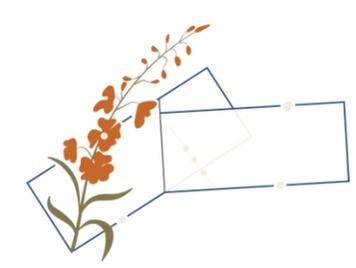
Industry Breakdown in Tyonek, AK



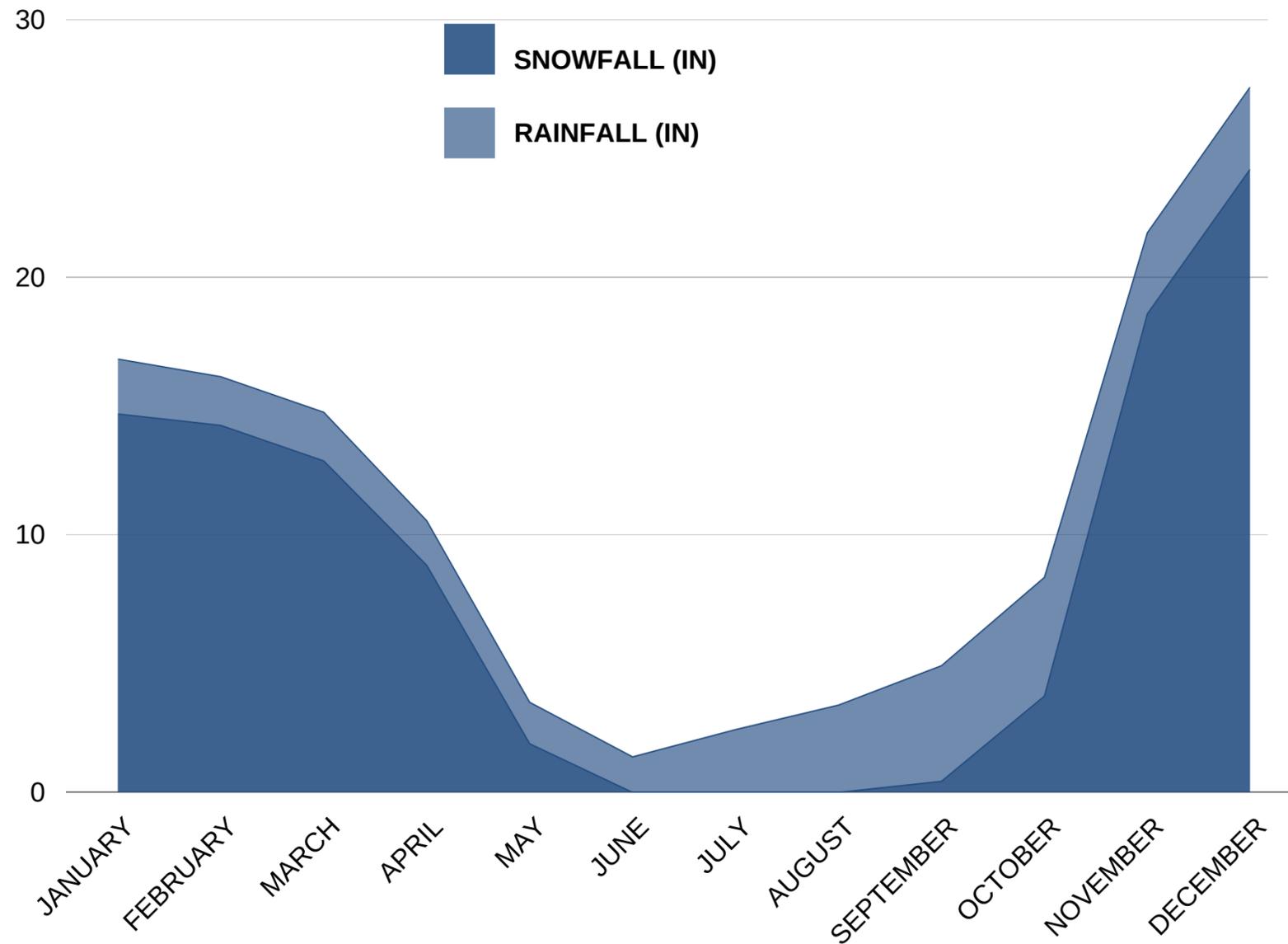
Median Household Income: \$38,125

Around **half** of Alaska's (\$80,827)

Primarily Native Alaskan population

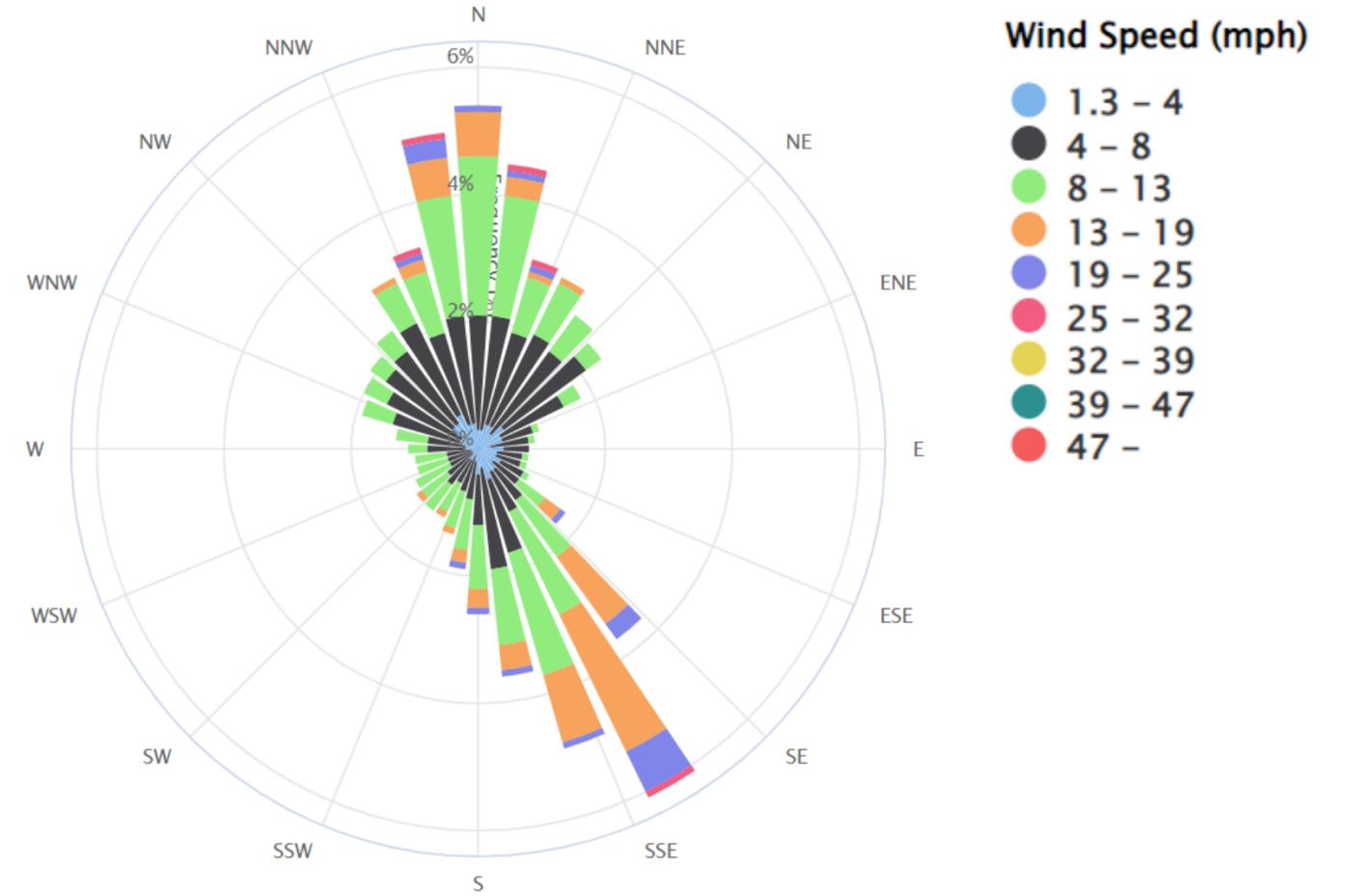


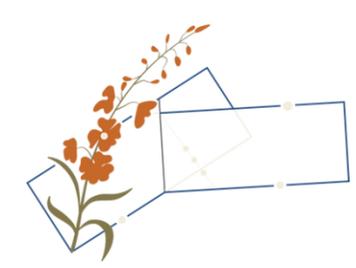
AVERAGE RAINFALL / SNOWFALL



ANCHORAGE INTL AP (AK) Wind Rose

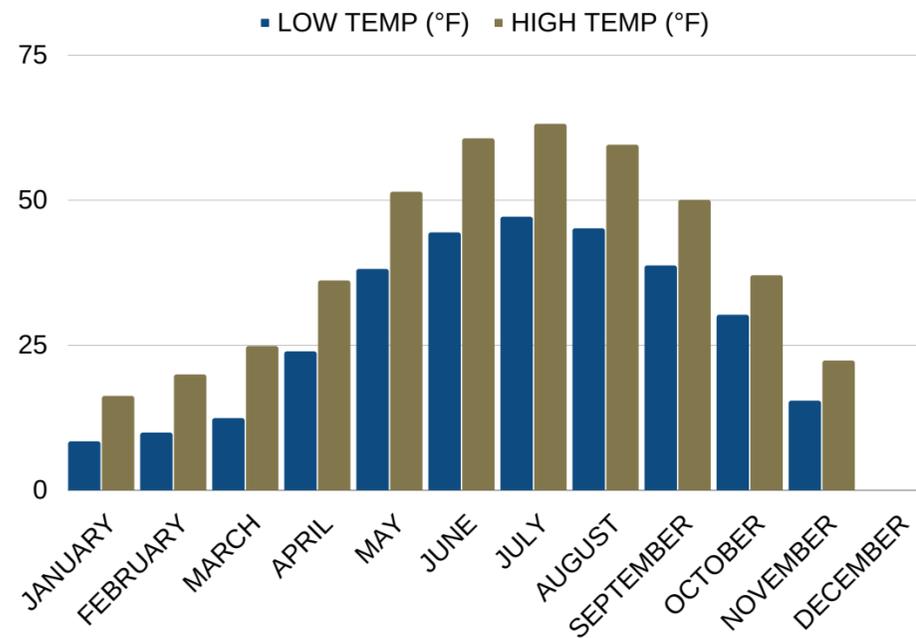
Jan. 1, 2022 - Feb. 20, 2023
Sub-Interval: Jan. 1 - Dec. 31, 0 - 23



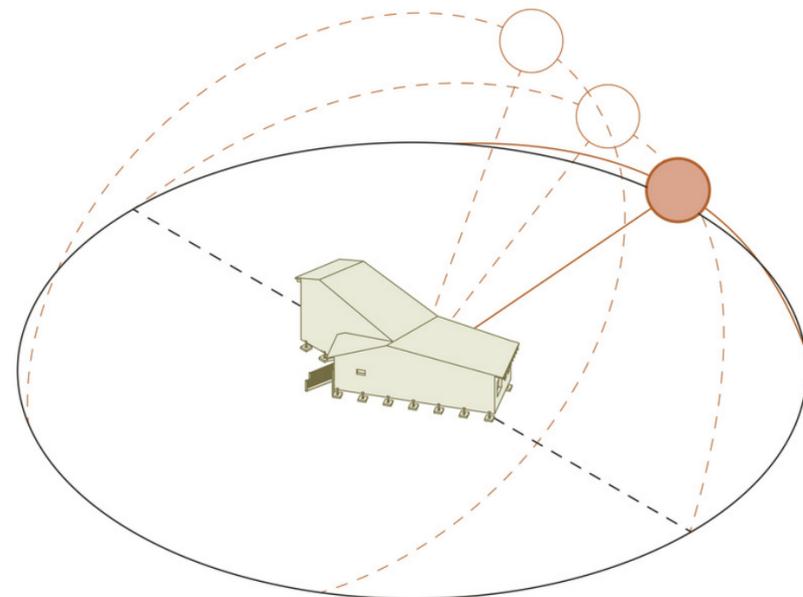
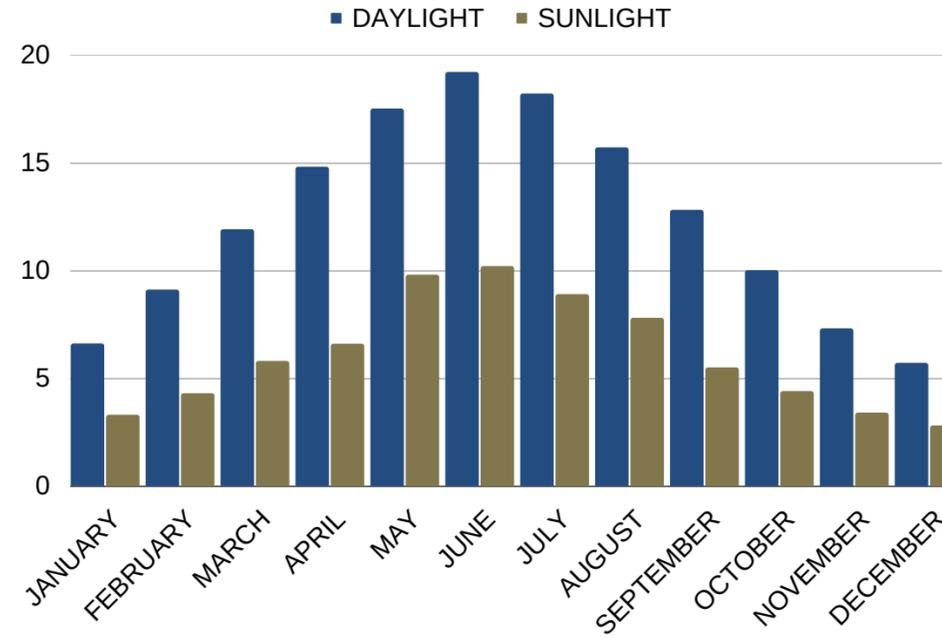


SUNLIGHT

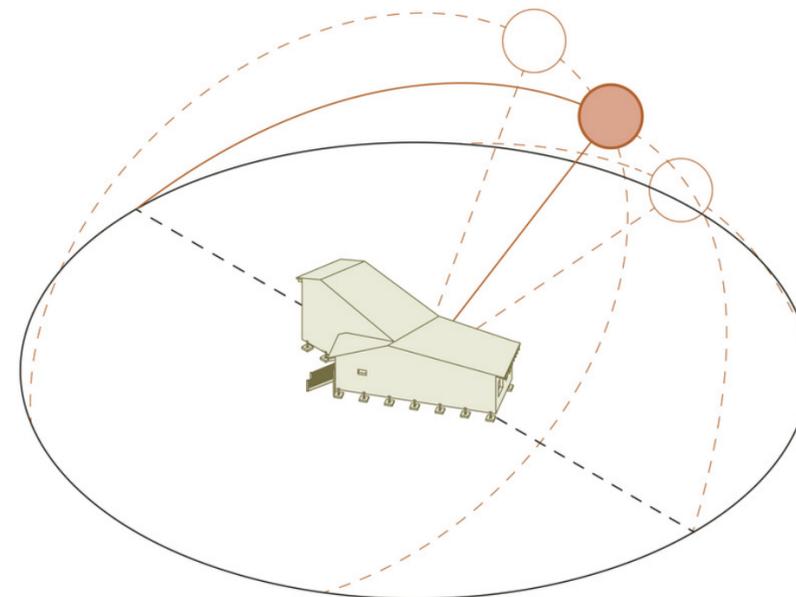
AVERAGE HIGH AND LOW TEMPERATURES



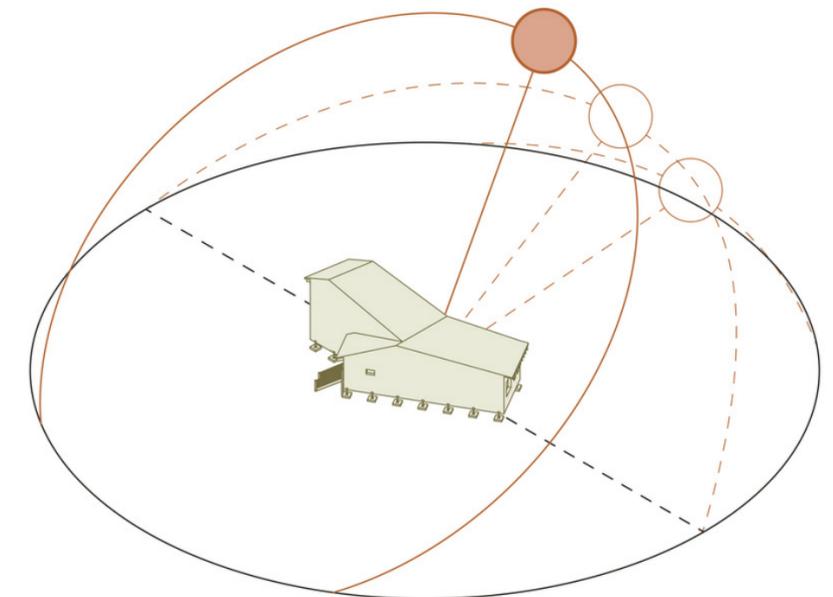
DAYLIGHT HOURS / SUNLIGHT HOURS



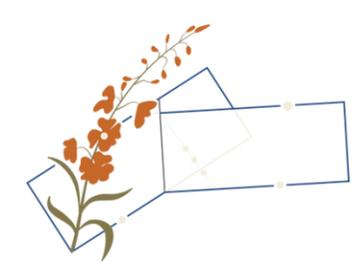
Winter Sun - 5° altitude



Fall/Autumn Sun - 29° altitude



Summer Sun - 53° altitude



EXPLORING THE POSSIBILITIES

Existing Conditions



Code Compliant

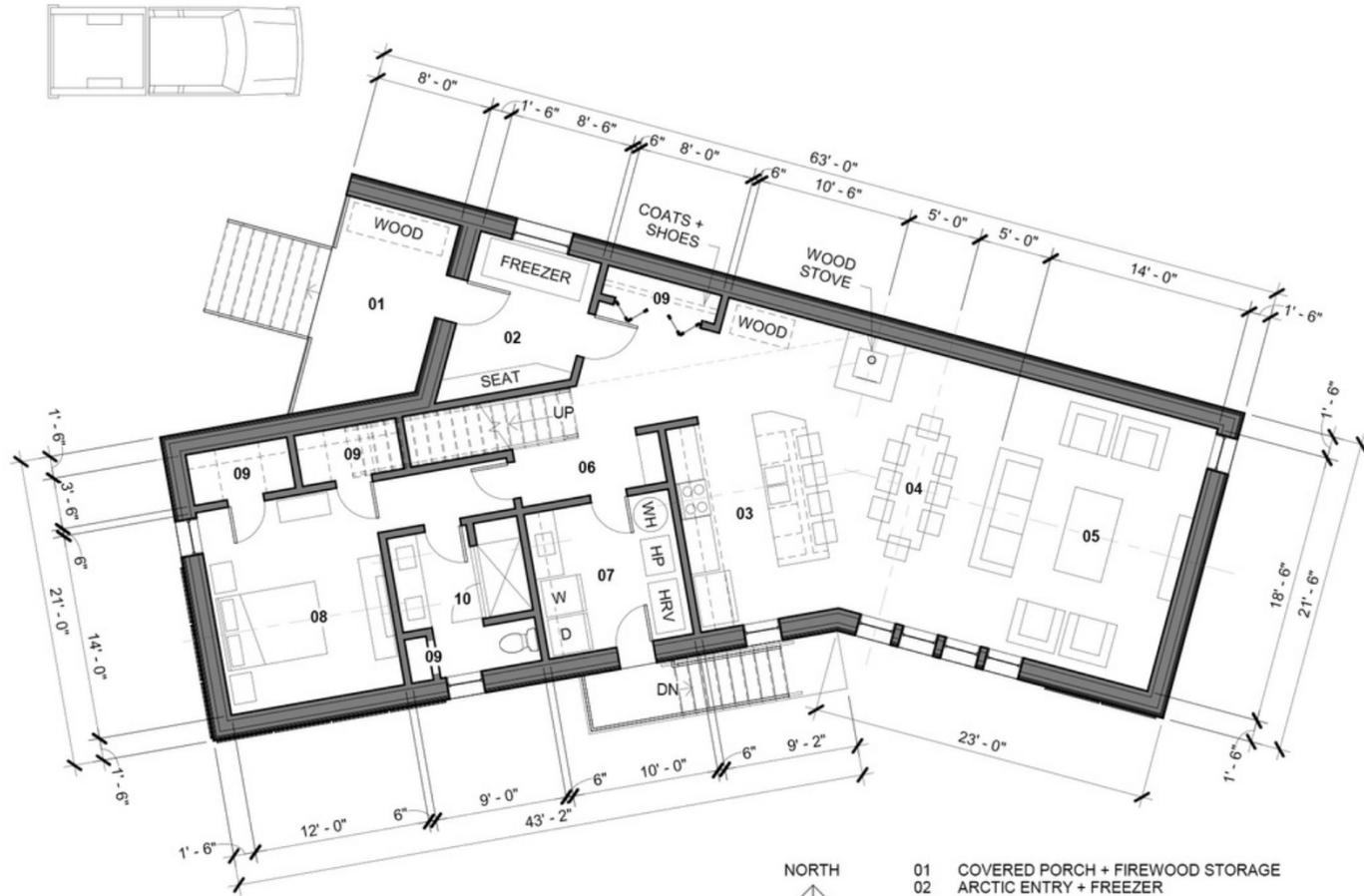


Our Proposal





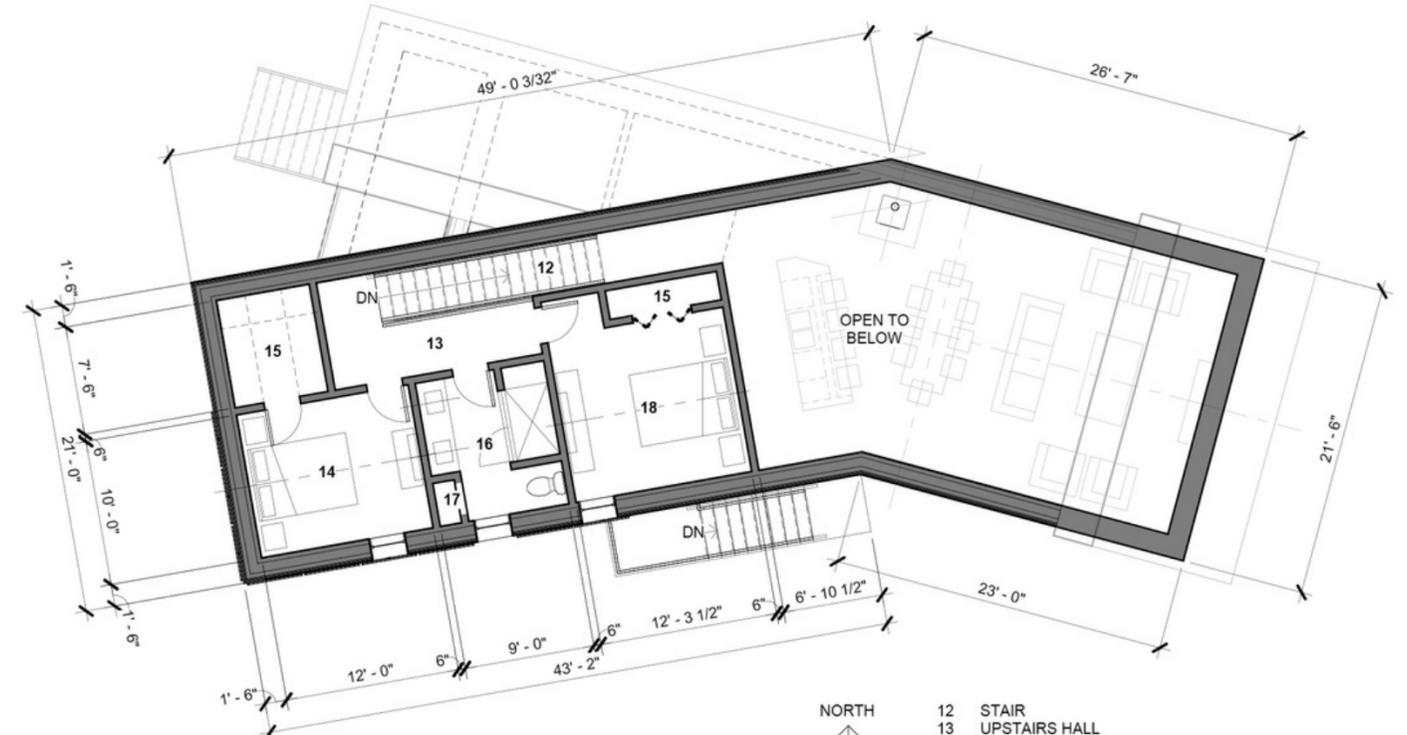
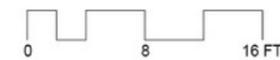
PLANS



Level 1



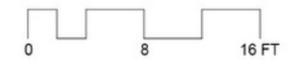
- 01 COVERED PORCH + FIREWOOD STORAGE
- 02 ARCTIC ENTRY + FREEZER
- 03 KITCHEN
- 04 DINING
- 05 LIVING / FAMILY ROOM
- 06 HALL / PANTRY
- 07 LAUNDRY + MECHANICAL EQUIP
- 08 BEDROOM #1
- 09 CLOSET
- 10 BATH #1
- 11 LINEN CLOSET

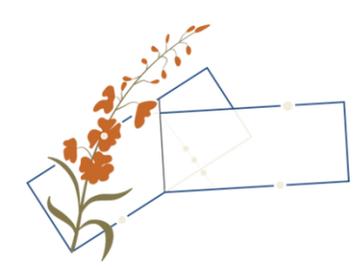


Level 2

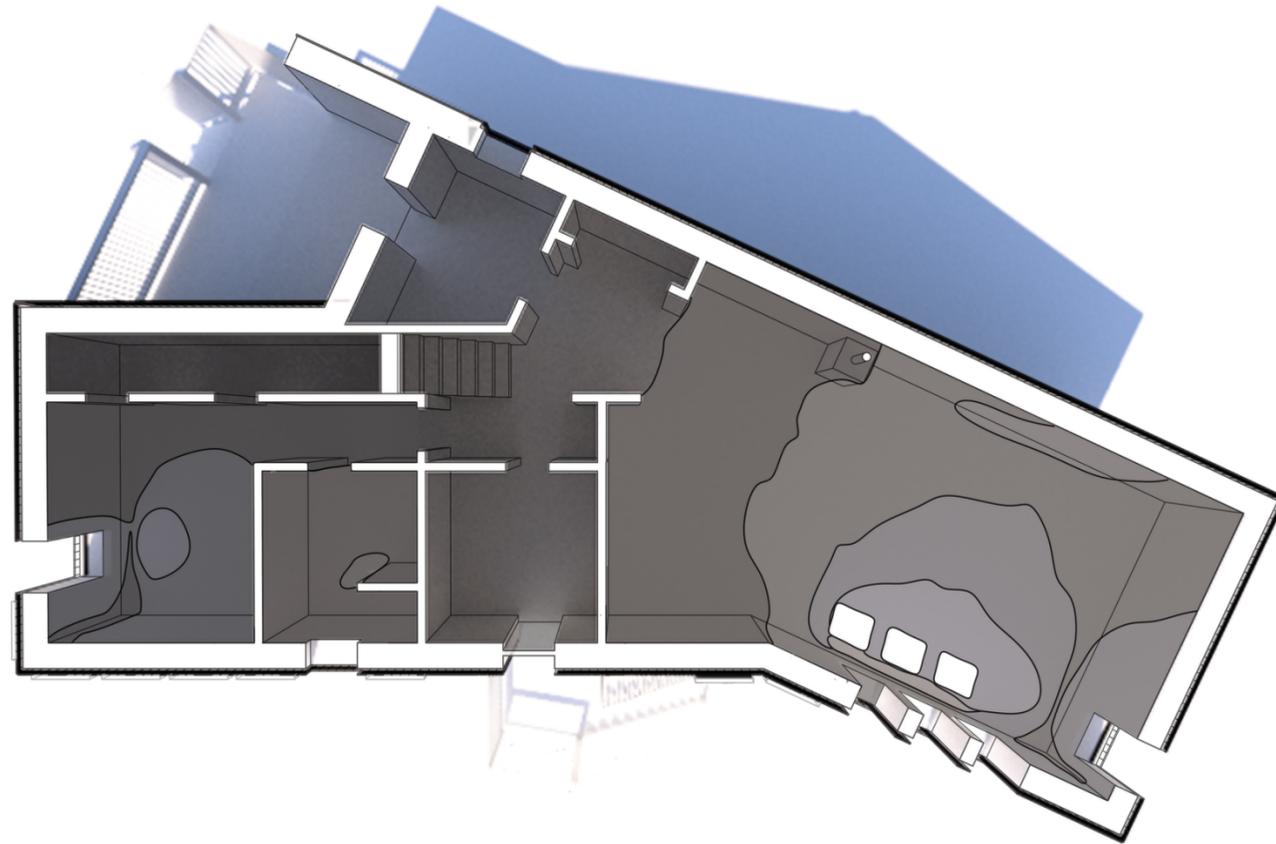


- 12 STAIR
- 13 UPSTAIRS HALL
- 14 BEDROOM #2
- 15 CLOSET
- 16 BATHROOM #2
- 17 LINEN CLOSET
- 18 BEDROOM #3 (OR LOFT OPEN TO BELOW)

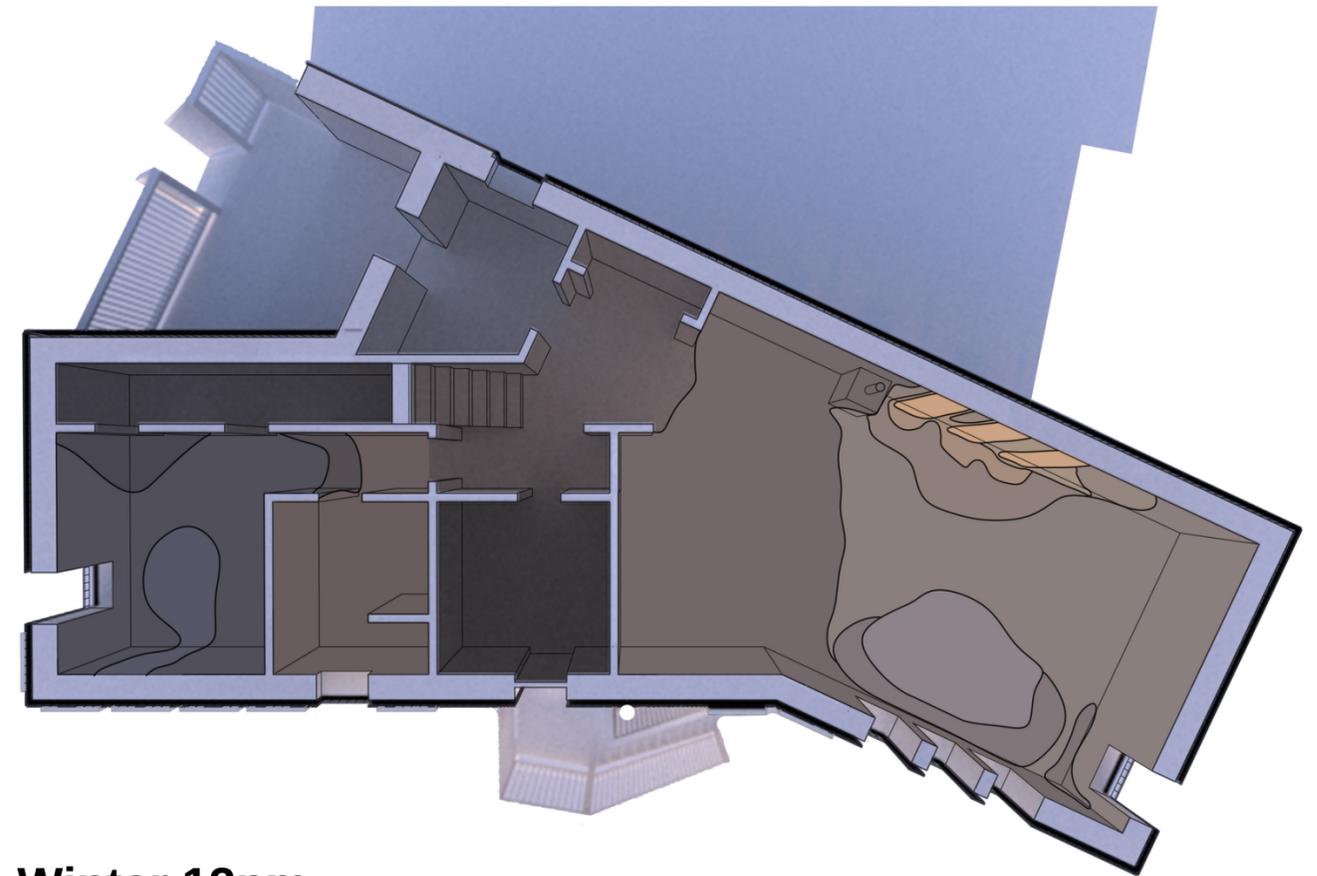




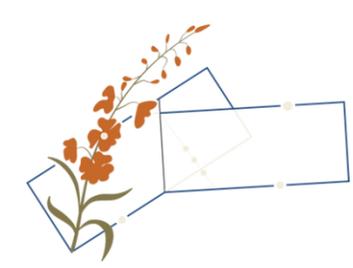
PASSIVE DAYLIGHTING DIAGRAMS



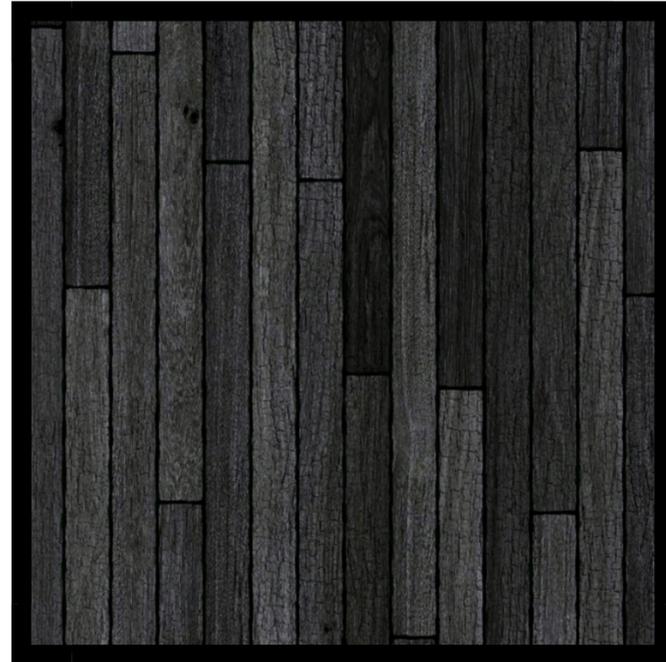
Summer 12pm



Winter 12pm



MATERIALS



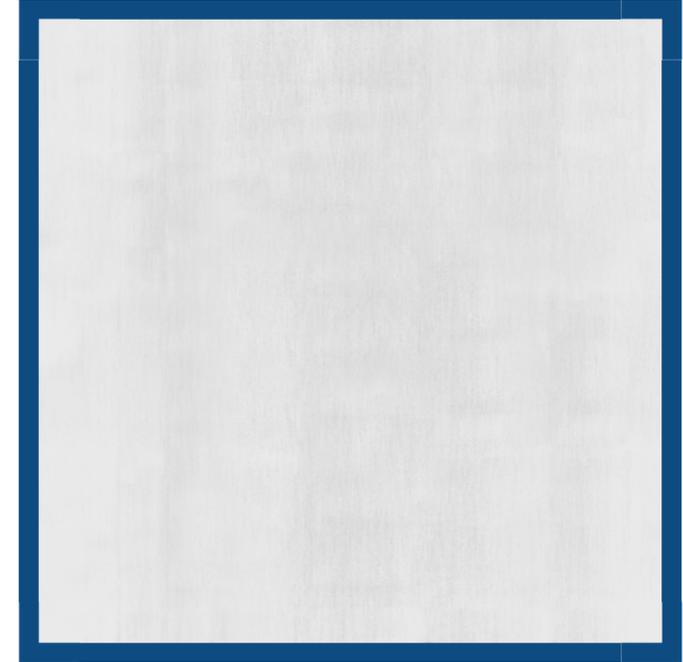
Shou Sugi Ban Charred Wood Siding

Weather resistant.
Recyclable.
Strong insulator.
Sustainably compliant.
Bug resistant.



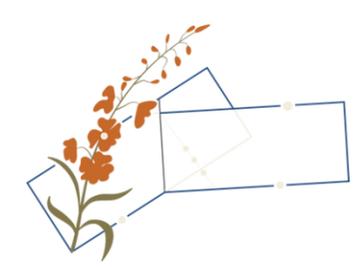
Interior Wood Finishes and Trim

Adaptable.
Durable.
Pleasant material.
Recyclable.
Warm.



Aluminum

Highly durable.
Resists snow loads.



INTERIOR ATMOSPHERE



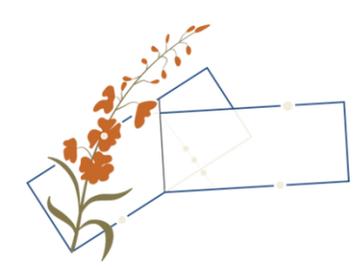
Kitchen Space

Main Arctic Entry

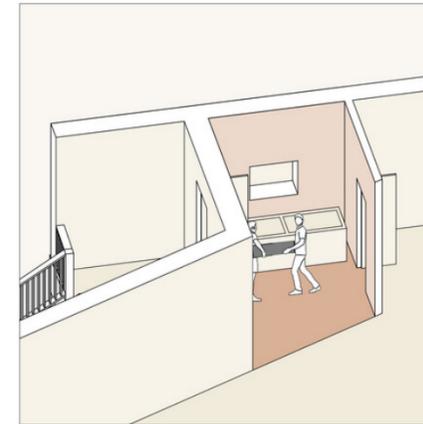
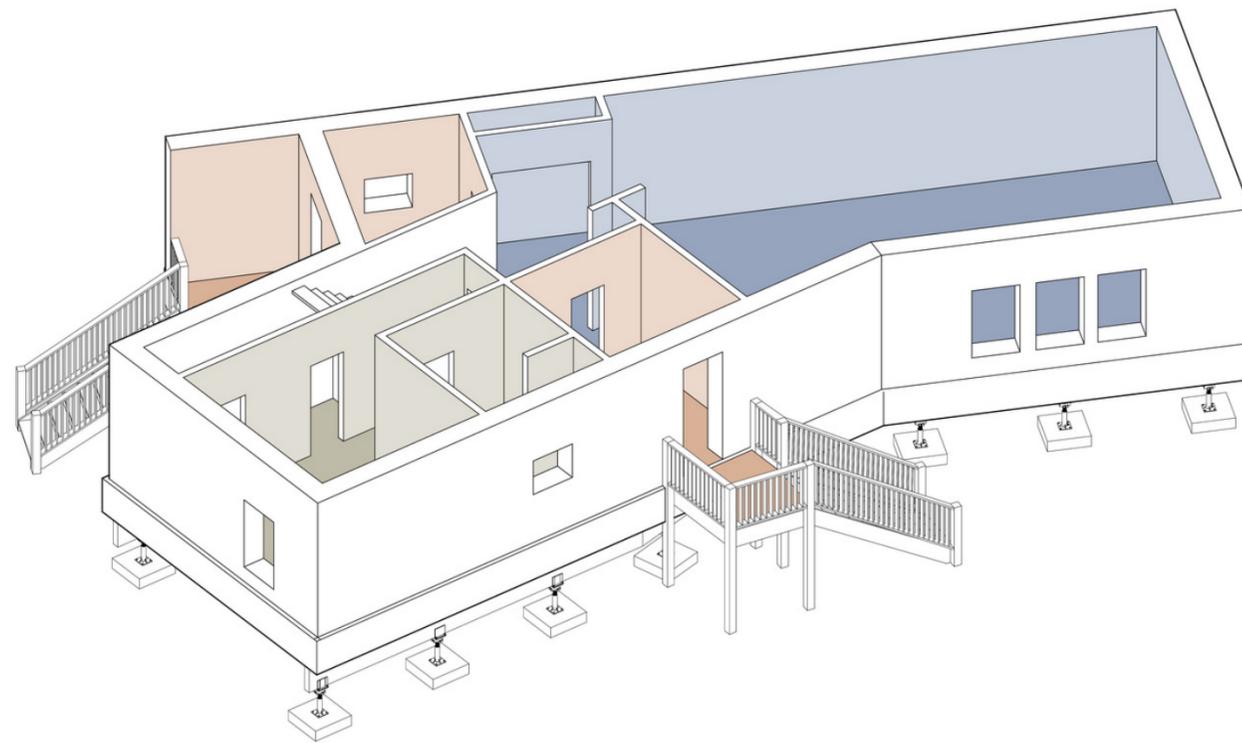
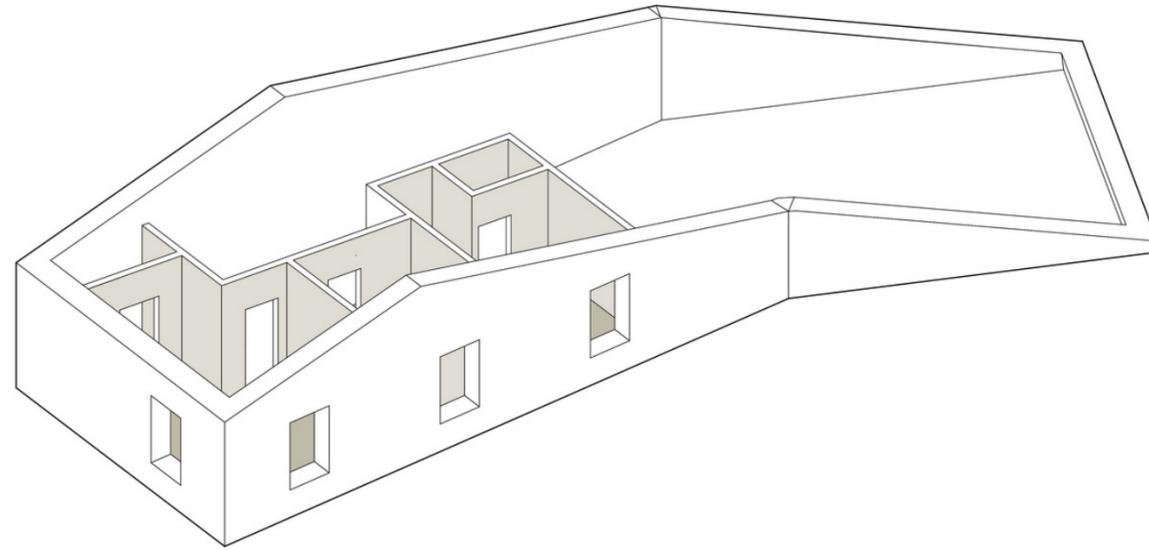


Dining Area from Main Entry

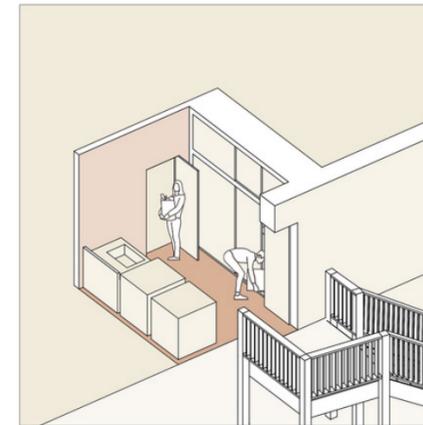




SPATIAL ITINERARIES



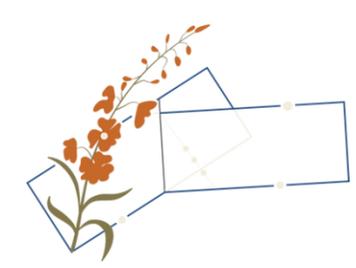
a. primary entrance
- public / community usage
- straight arctic entry for large items



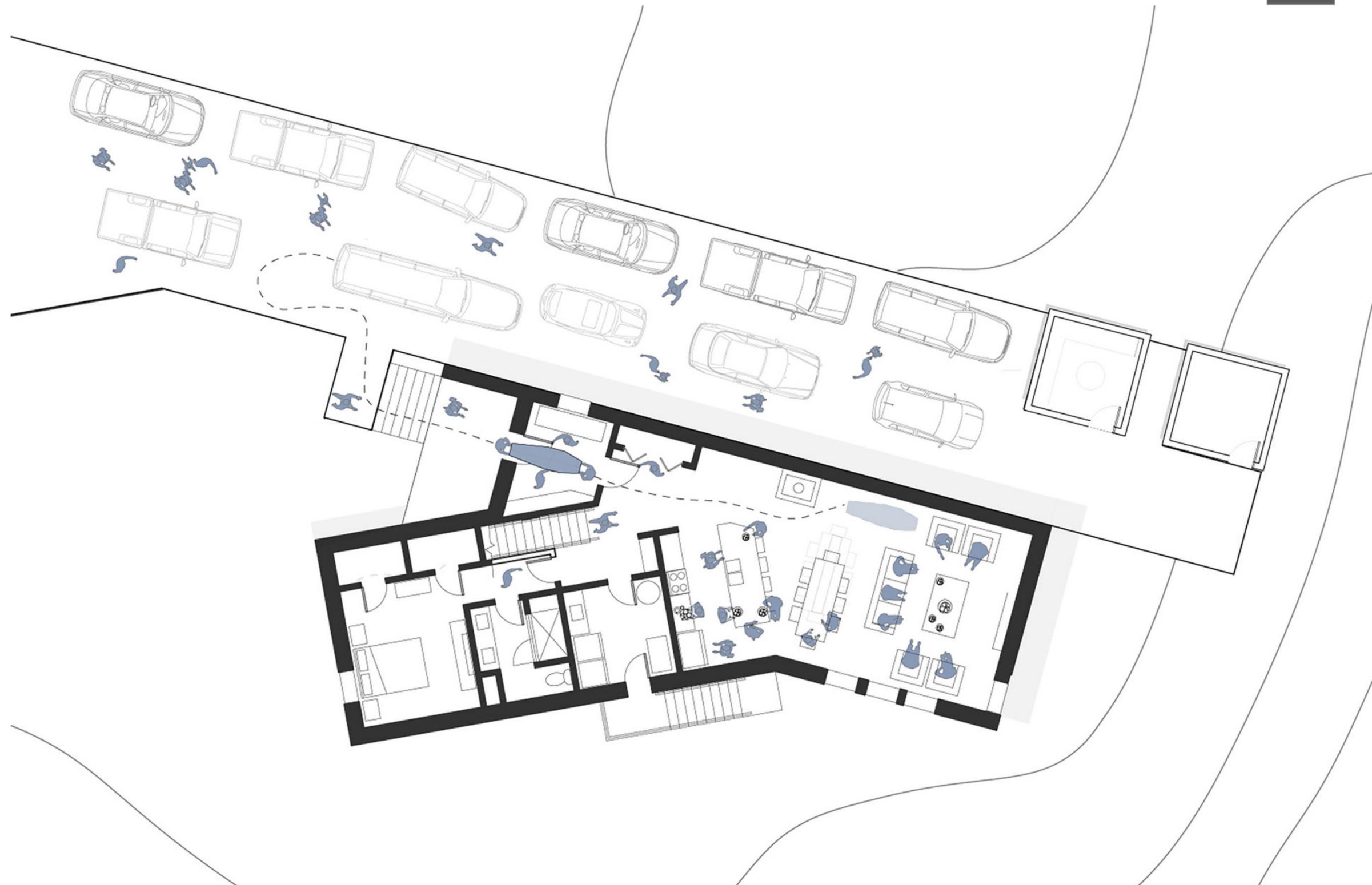
b. secondary entrance
- private / resident usage
- arctic entry with built-in storage

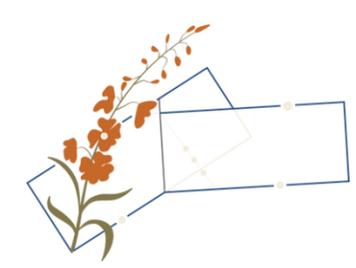
c. organization of program

-  transitional spaces (entry/exit)
-  community / family spaces
-  private bedroom/bathroom spaces

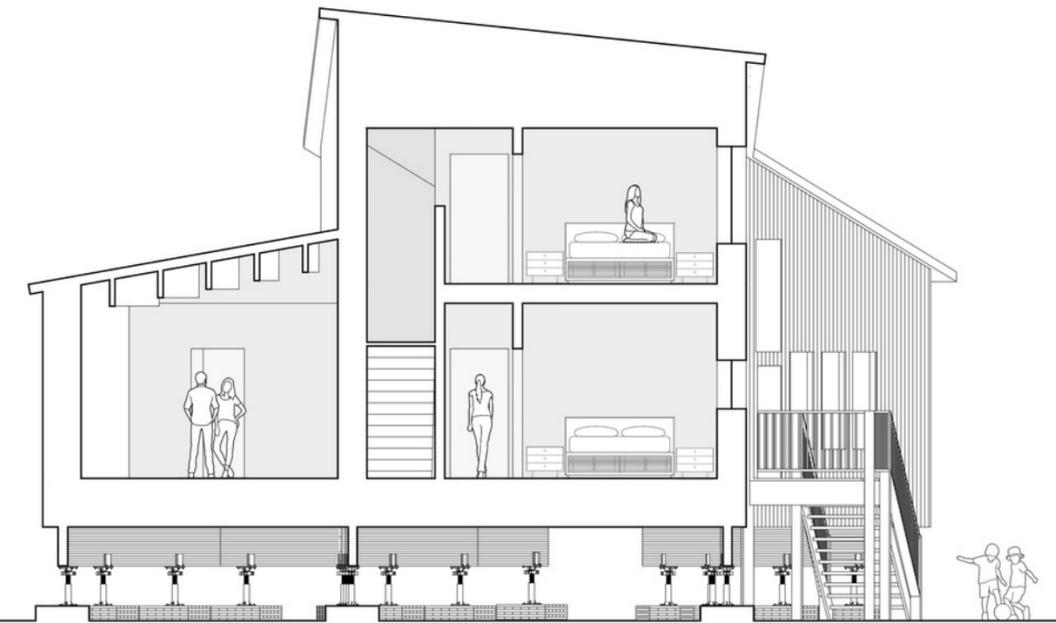
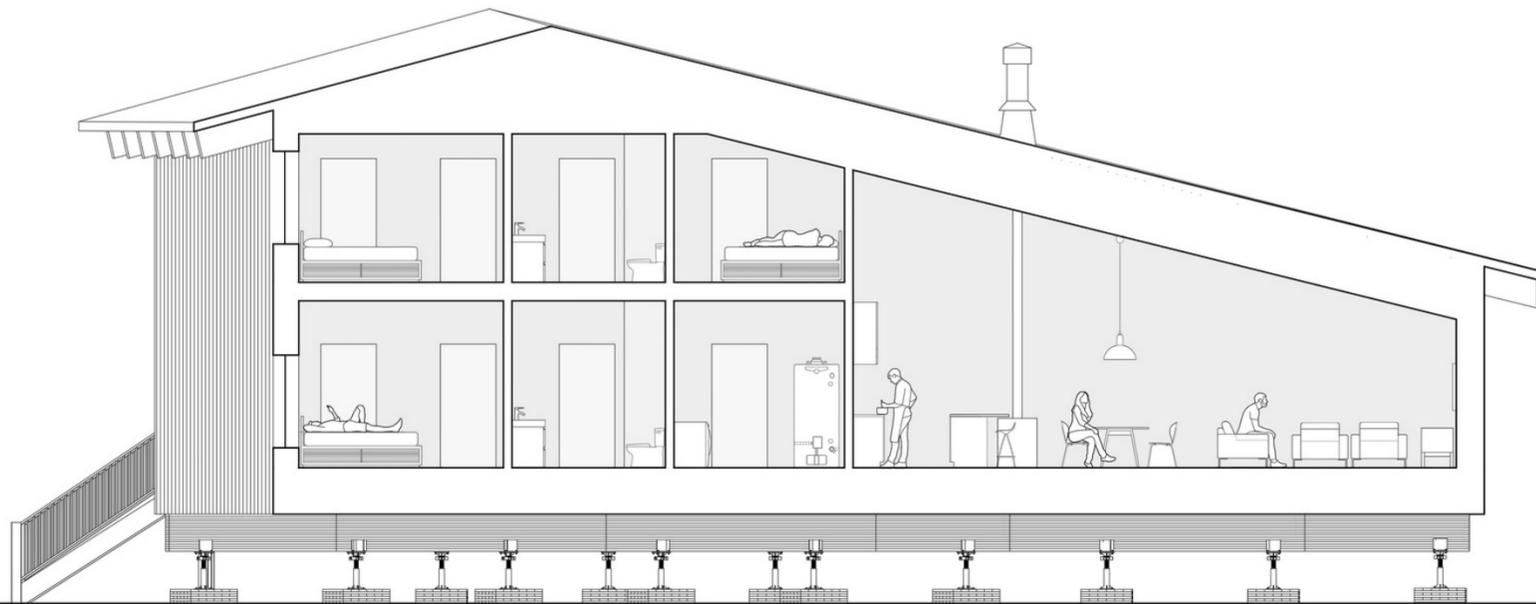


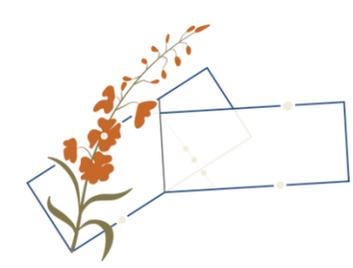
SPATIAL ITINERARIES



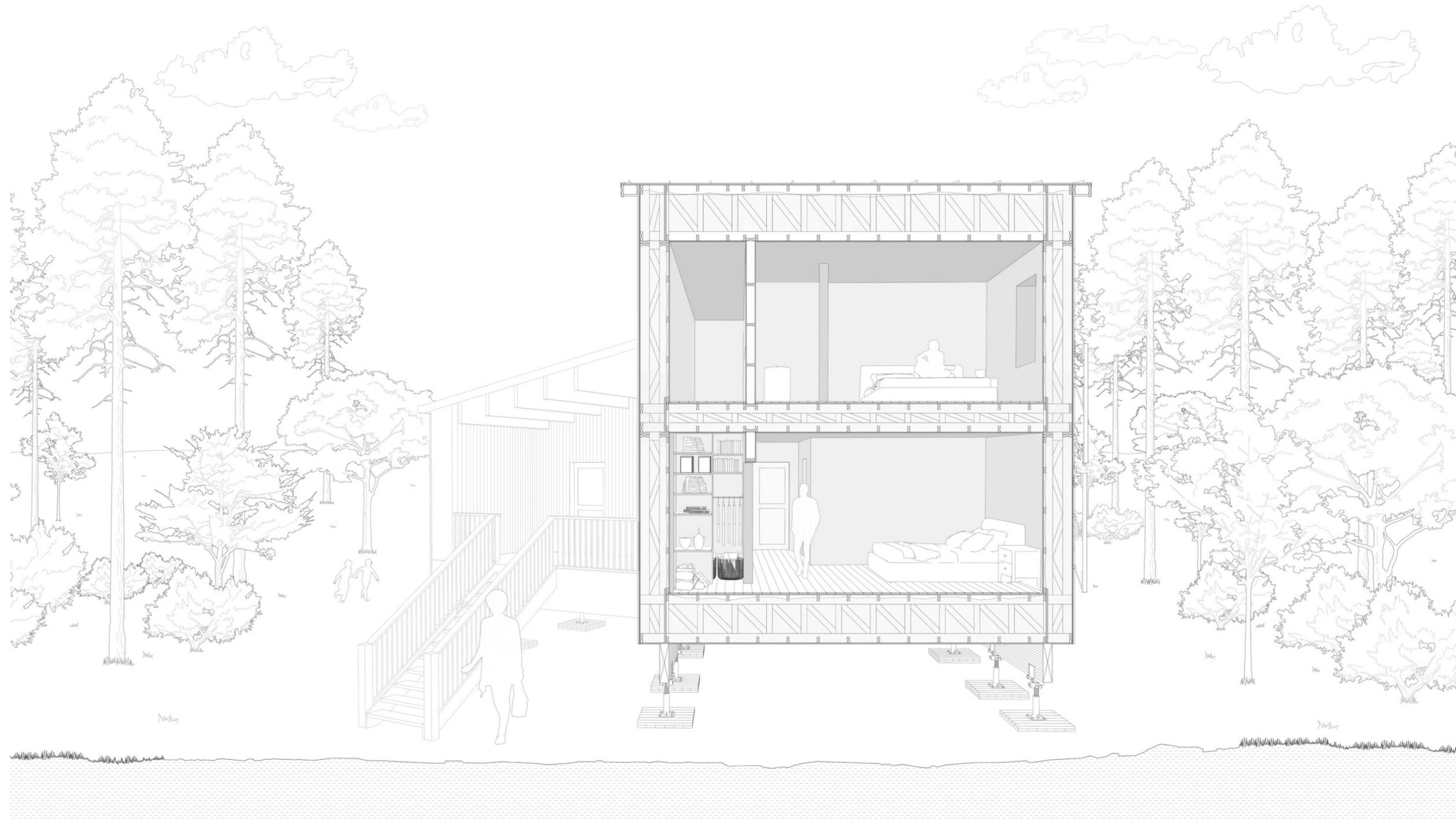


SECTIONS





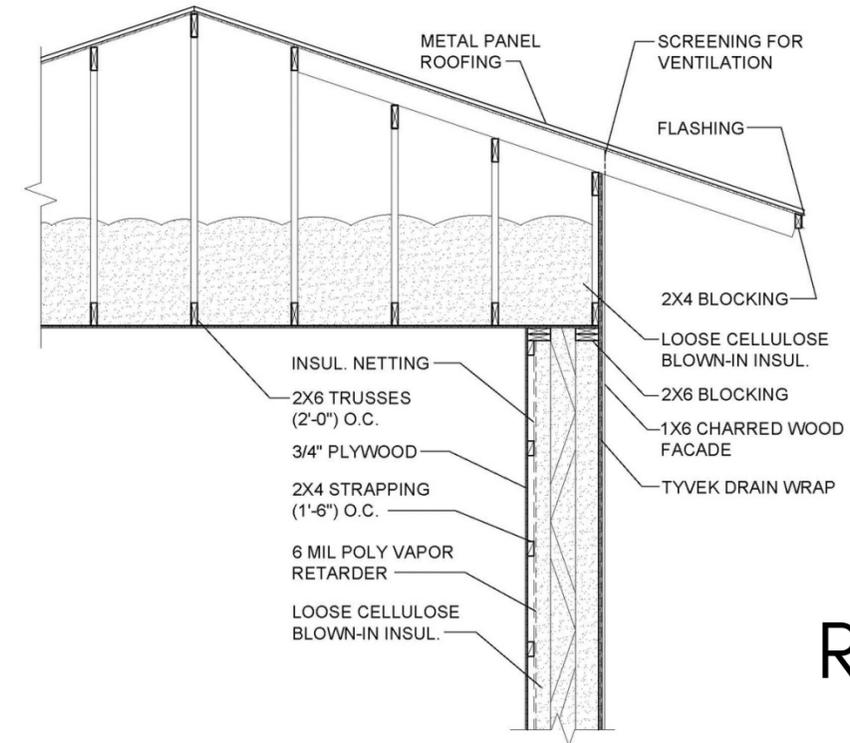
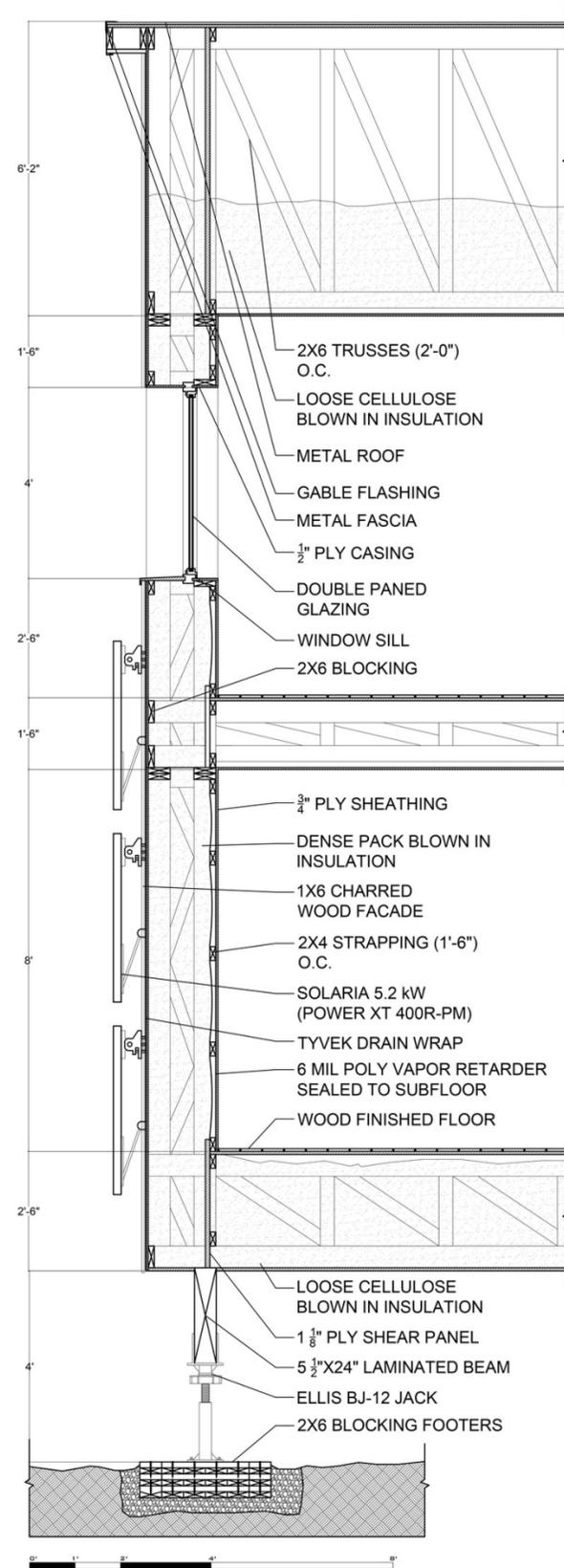
SECTION PERSPECTIVE



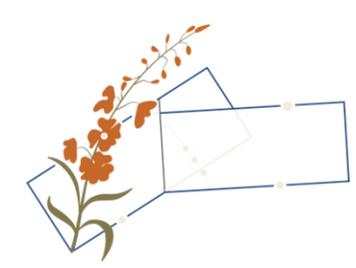


DETAILS

WALL SECTION



ROOF DETAIL

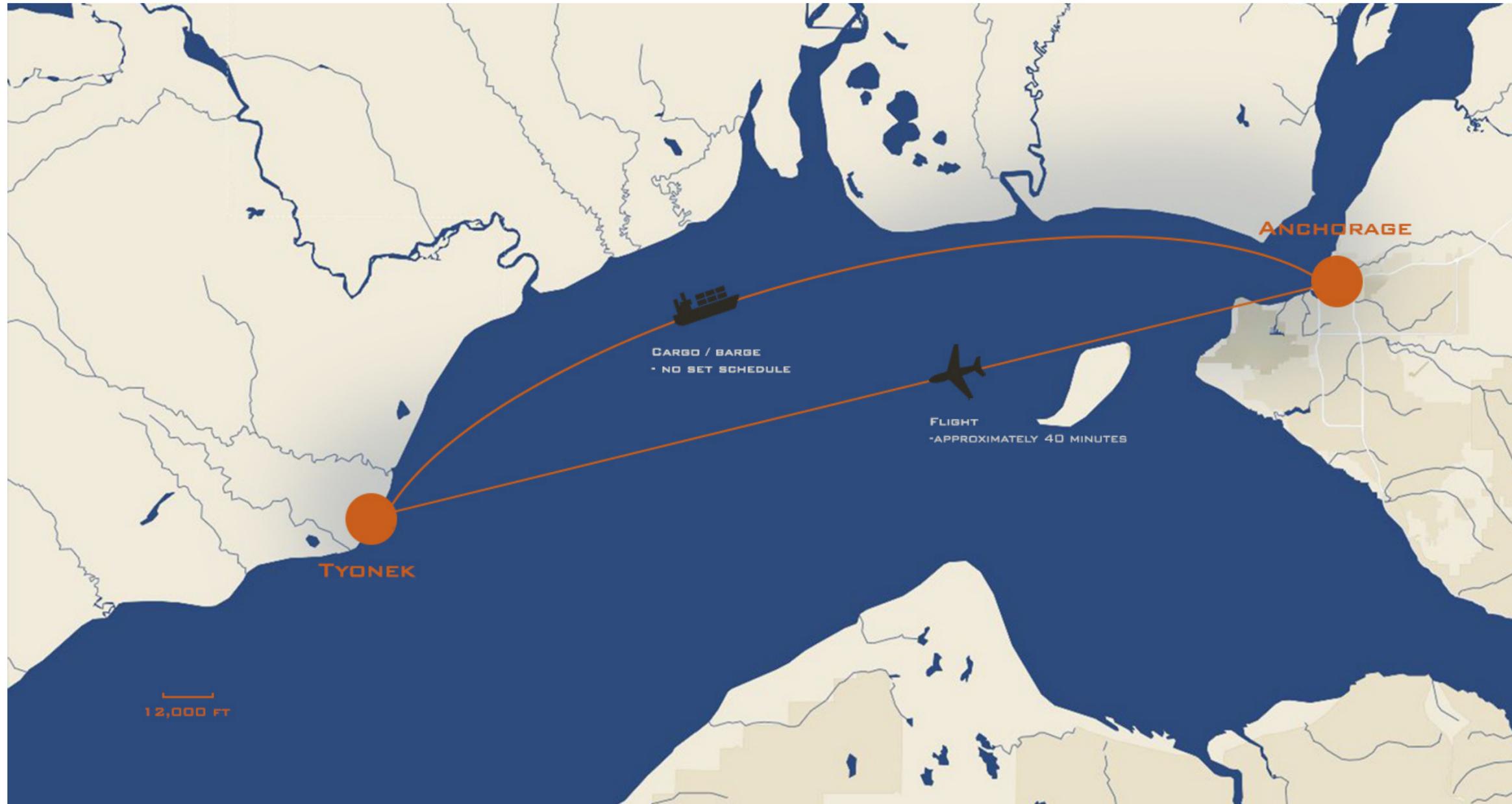


PHYSICAL MODEL





MARKET READY MATERIALS



Alaska Cargo:

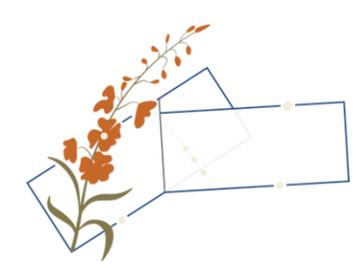
- Screening Fee = \$0.05/lb
- General Air Freight rate = \$1.02/lb
- Priority Freight = \$1.62/lb

Lynden Air Cargo:

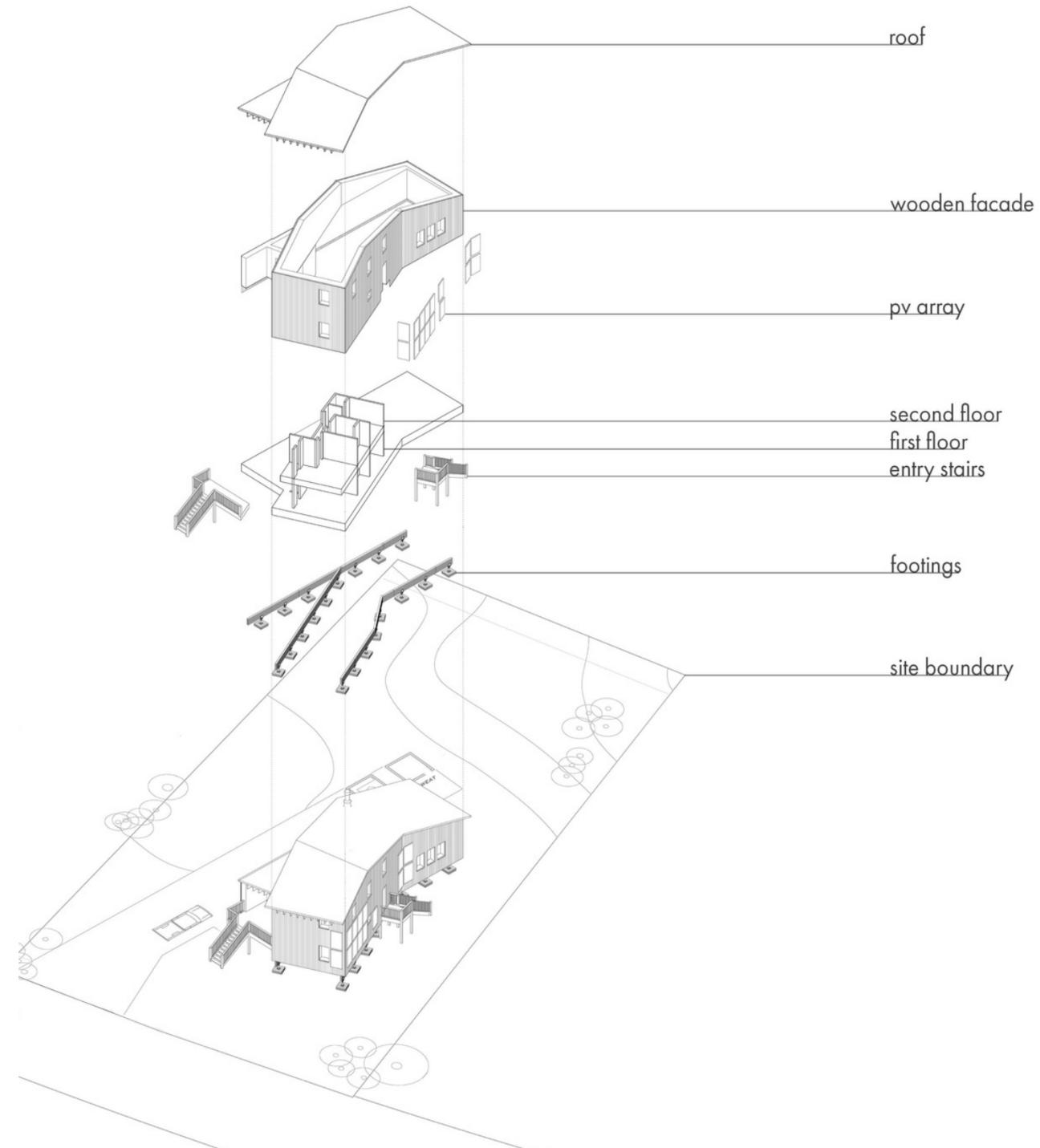
- General Freight rate:
 - \$60.00 (0-137lb)
 - \$0.44/lb (138+lb)

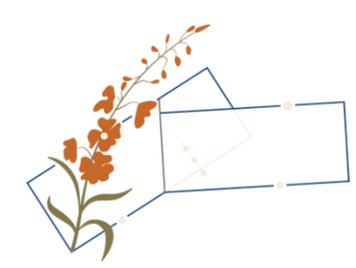
Alaska Tug & Barge:

- 19,915,500 lbs
- \$30,000 per load



INTEGRATED SYSTEMS





ELEVATIONS



South Face



West Face



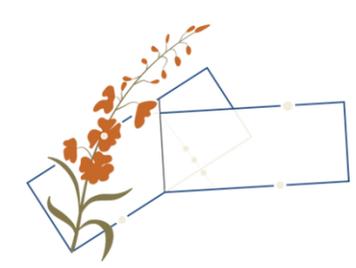
East Face



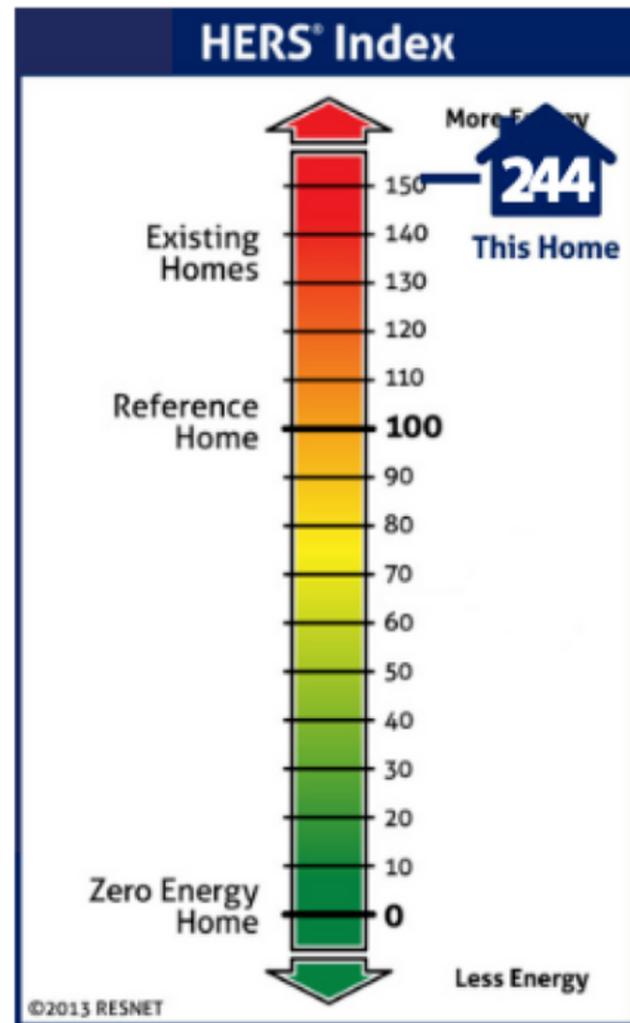
North Face



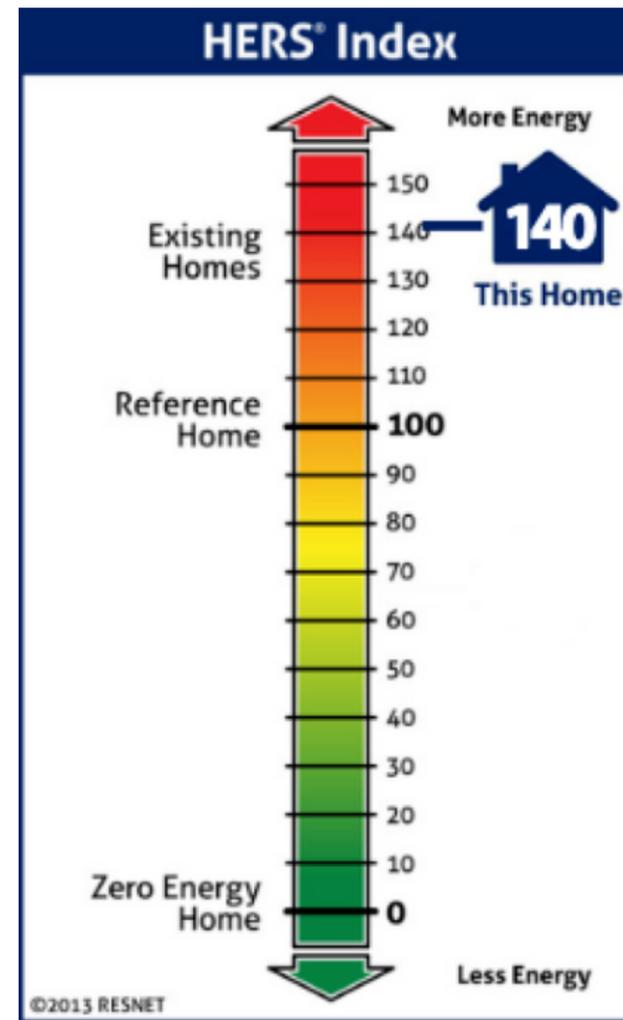
1/8" = 1' Scale Model



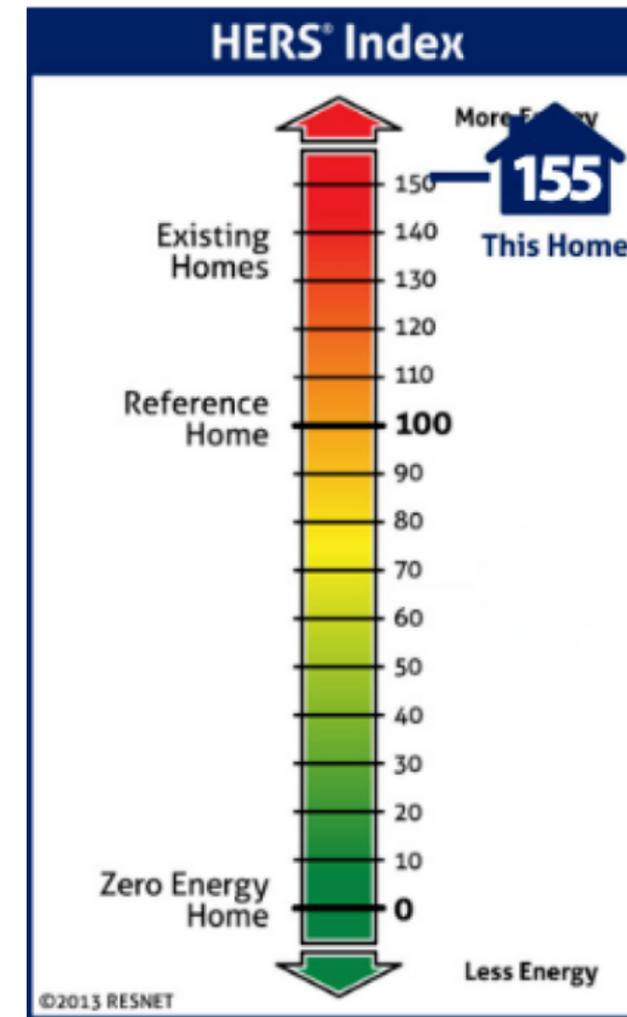
HERS INDEX SCORE COMPARISON



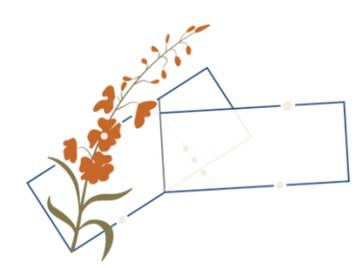
Earliest Houses



Earliest Houses
w/ Improvement



Suburb Houses



HERS INDEX SCORE COMPARISON

Teacher's Housing:
Code Compliant Baseline

HERS score:
61

Our Proposal:

HERS score:
22*



***w/ pv array**



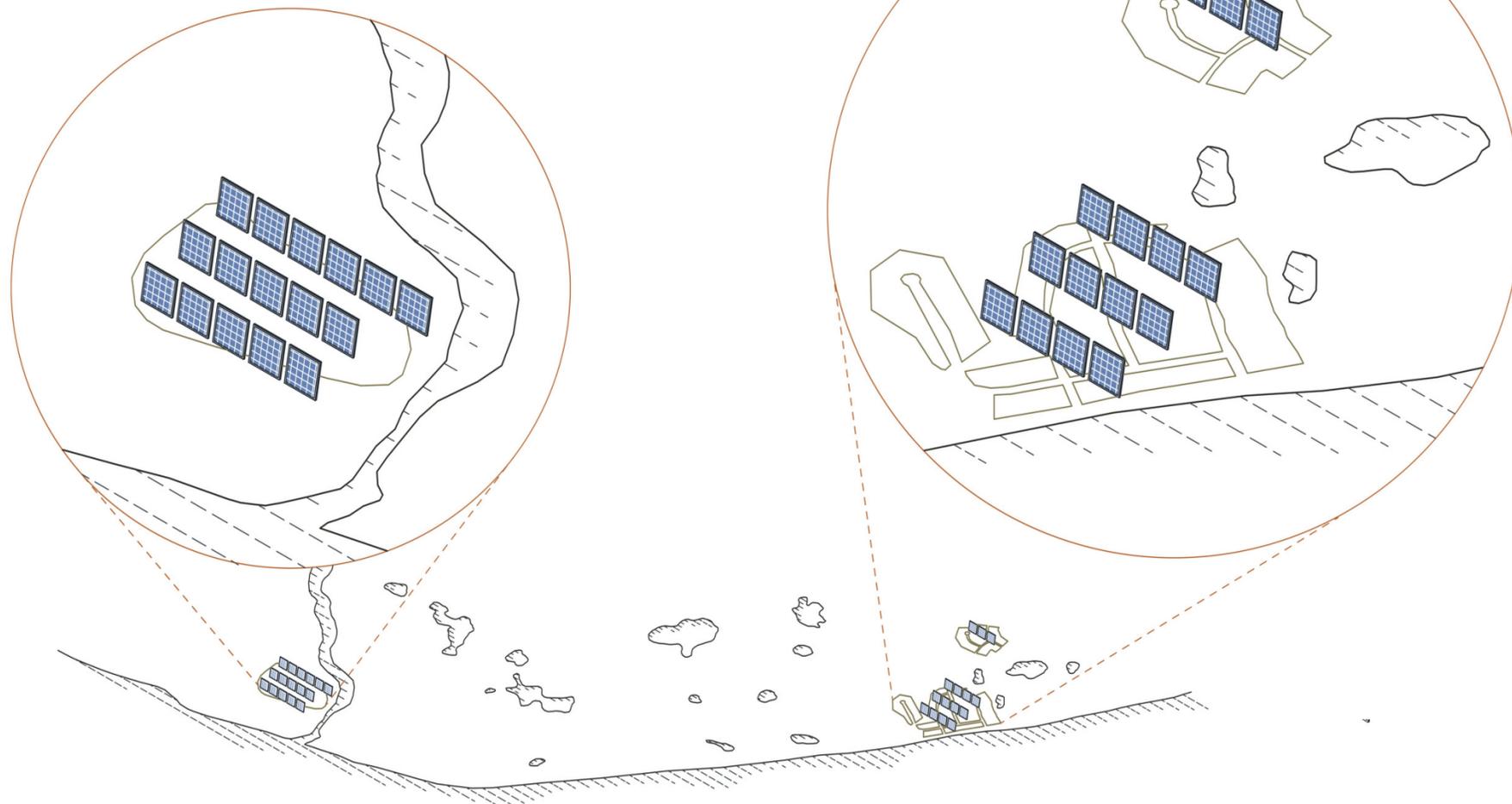
SOLAR DATA

Residential Production

337 MWh annual production

Community Solar Farm

725 MWh annual production

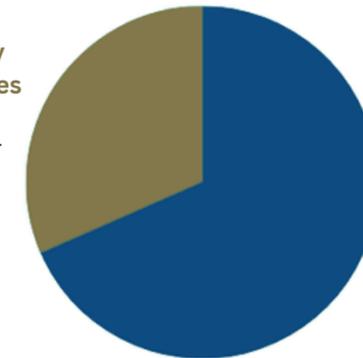


Annual Demand - 1,020,000 kWh needed per year
Residential Production - 335,000 kWh per year;
Distributed Along 92 Lots - 3,641.4 kWh per year

12 Solaria PowerXT 430R-PL will produce 5,160 W in perfect conditions. Taking climate into consideration, our 5W DC System will produce **3,696 kWh per year per home**

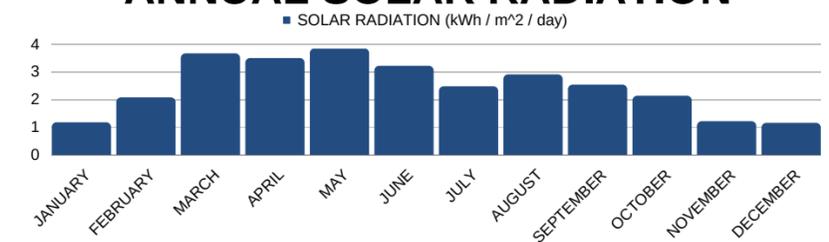
PV ENERGY GENERATION

Production By
Proposed Homes
31.6%
335 MWh Per Year

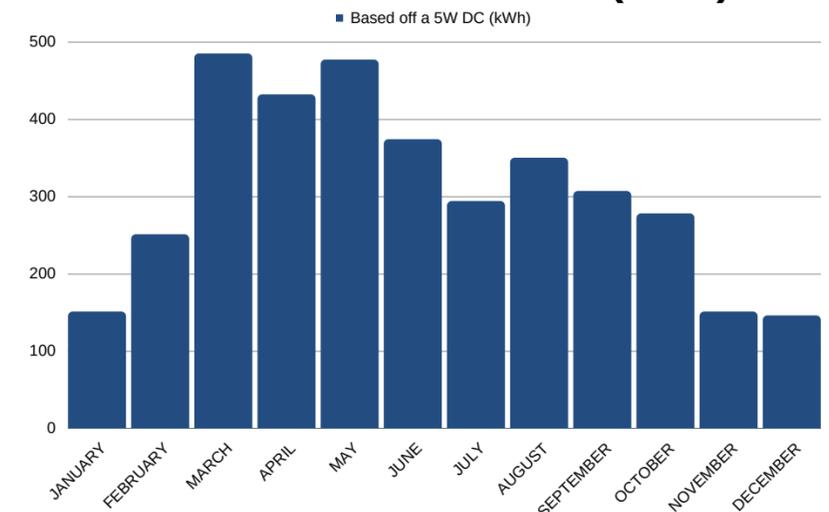


Production from
Solar Farm **68.4%**
725 MWh Per Year

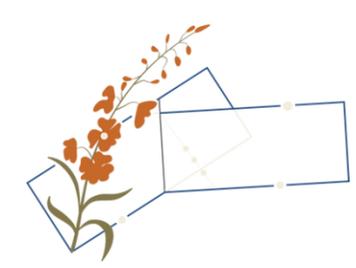
ANNUAL SOLAR RADIATION



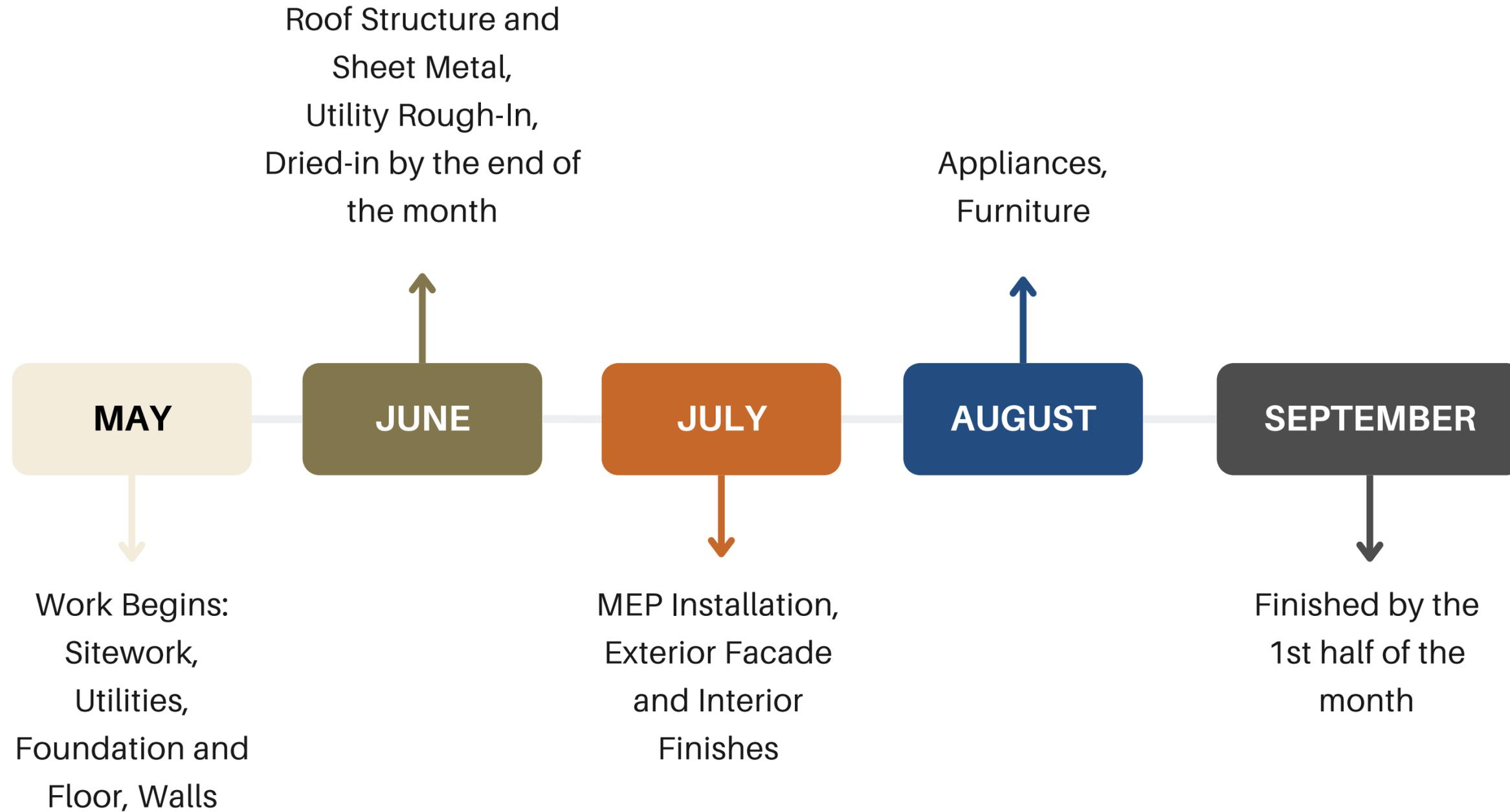
ANNUAL AC ENERGY (kWh)

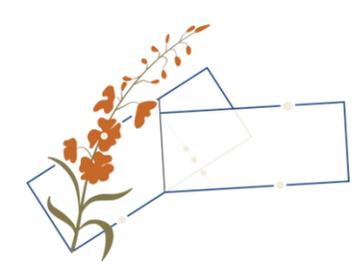


*Based off a 5W DC System
Data Calculated using NREL Solar Calculator



TIMELINE & BUDGET





CONSTRUCTION COST COMPARISON

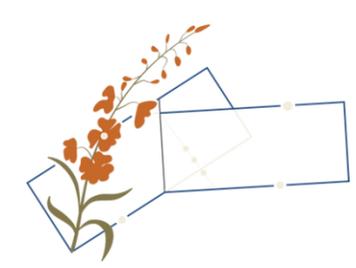
Code Compliant

\$270/sf

Our Proposal

\$251/sf





LIFE CYCLE COST COMPARISON



HOUSE			LIFE CYCLE COST
Fireweed Proposal	INITIAL \$494,909	OPERATIONAL \$295,677	\$790,586
Existing Teacher Housing	INITIAL \$672,896	OPERATIONAL \$727,253	\$1,400,149

Life Cycle Cost Includes:

- **Initial Costs:**
 - All Material Costs
 - All Shipping Costs
 - Construction Costs
- **Operational Costs:**
(over 50 year study period)
 - Maintenance Costs
 - Replacement Costs
 - Energy Costs

(*) 50 yr study period, 2% Discount rate as per NIST Handbook 135



HEATING ENERGY COST COMPARISON

HOUSE

Heating Energy*



Fireweed
Proposal

\$78,570**

** Anticipated equivalent cost of energy for the house over a 50 year period, assuming \$0.26/kWh for power from the community solar farm.

When accounting for on-site and off-site solar generation, the cost over 50 years is \$0.

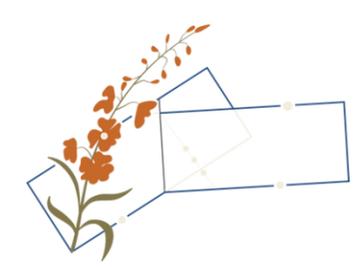


Existing
Teacher
Housing

\$207,750***

*** Based on Current Utility Bills

(*) 50 yr study period, 2% Discount rate as per NIST Handbook 135



LIFE CYCLE COST COMPARISON

HOUSE

Siding *



Fireweed Proposal

\$86,900

Burnt Fir Siding:

- Initial Costs:
 - \$86,157
- Operational Costs: (over 50 year study period)
 - \$743

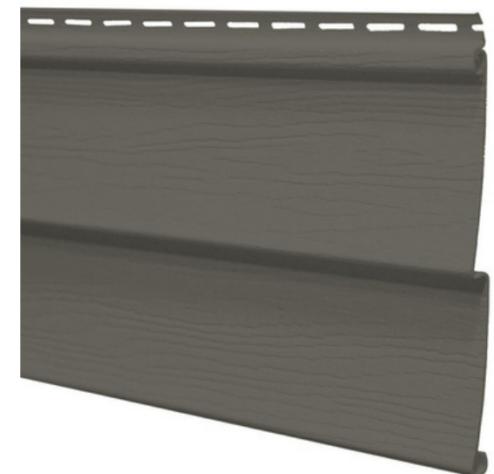


Existing Teacher Housing

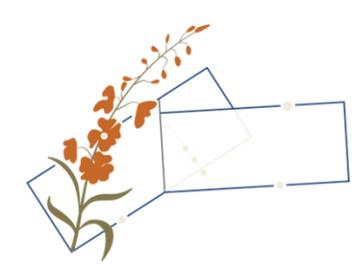
\$169,420

Vinyl Siding:

- Initial Costs:
 - \$31,132
- Operational Costs: (over 50 year study period)
 - \$138,288

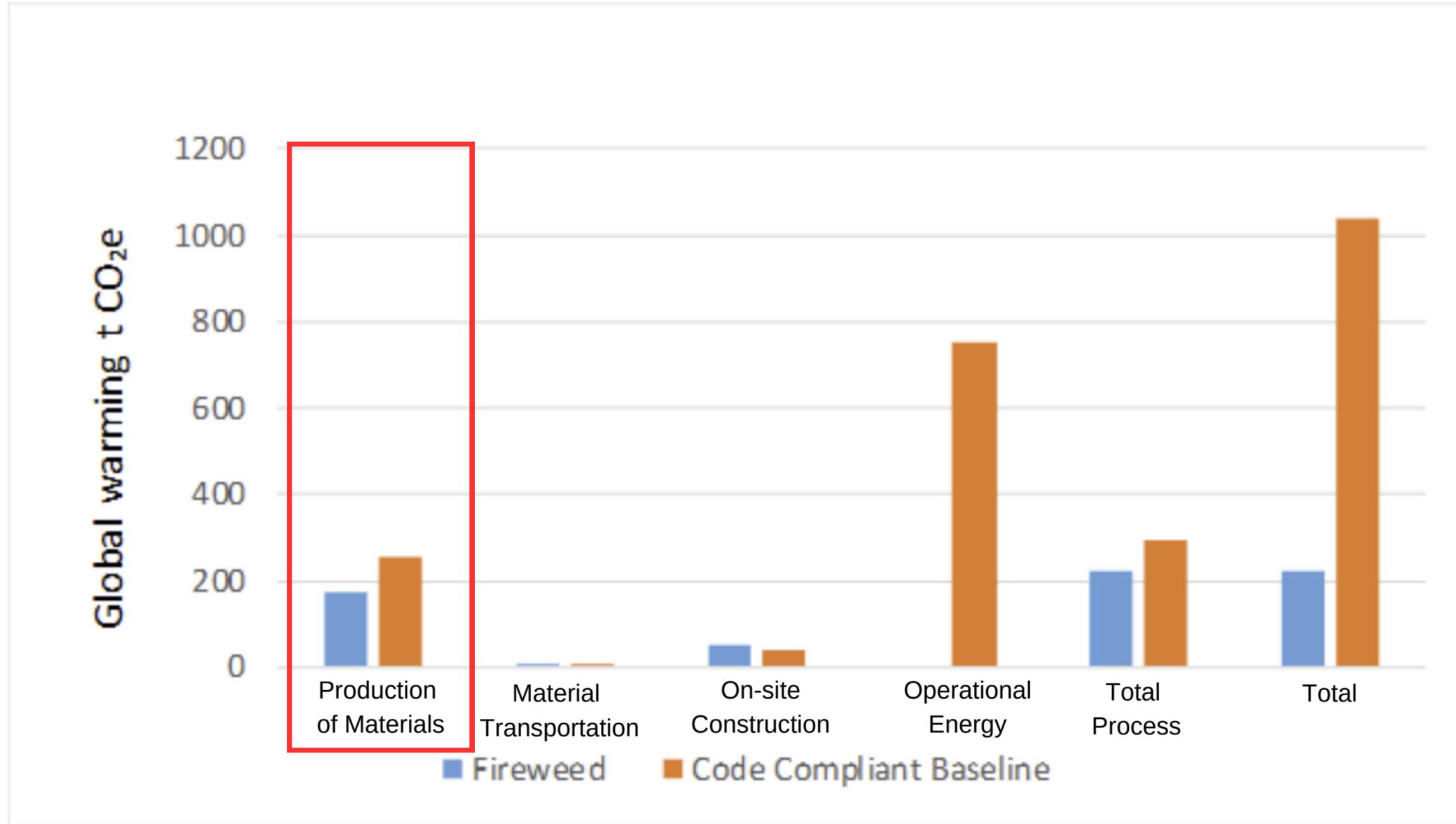


(*) 50 yr study period, 2% Discount rate as per NIST Handbook 135

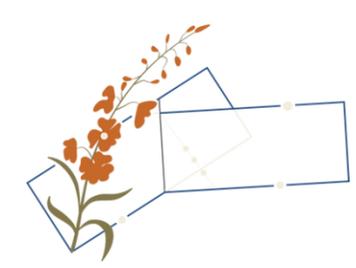


EMBODIED ENVIRONMENTAL IMPACT

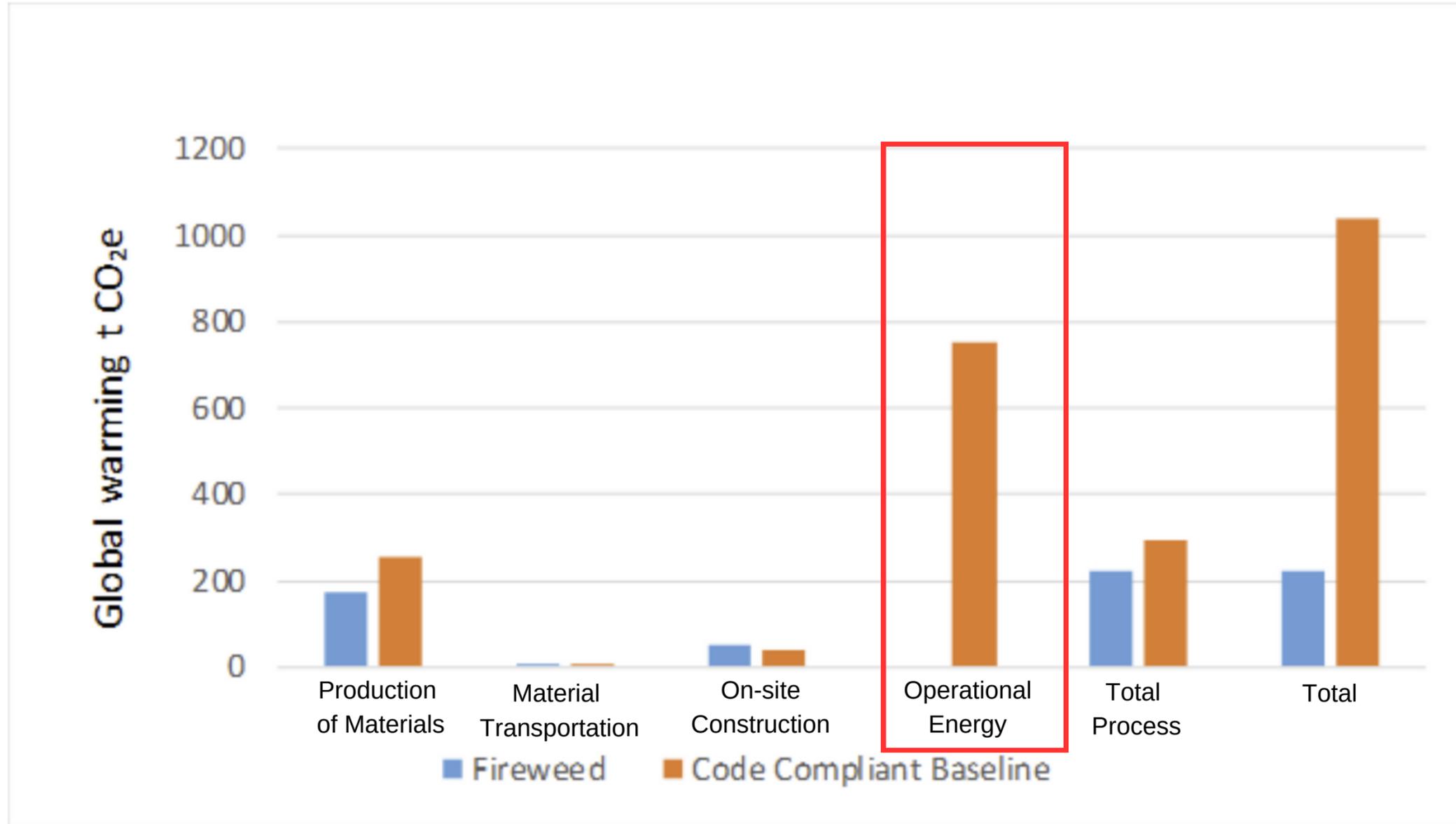
Embodied Carbon:
Reduced by 45%



(*) EN 15643:2021 DIN Deutsches Institut für Normung e. V. DIN EN 15643:2021-12, Sustainability of construction works
- Framework for assessment of buildings and civil engineering works 91.040.01. Beuth Verlag GmbH, Berlin 91.040.01



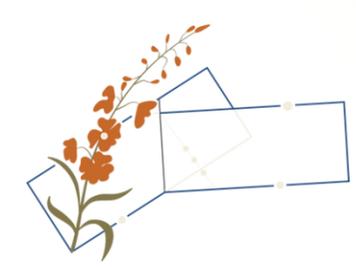
EMBODIED ENVIRONMENTAL IMPACT



Embodied Carbon:
Reduced by 45%

Green House Gas Emissions:
Reduced by 22%

(*) EN 15643:2021 DIN Deutsches Institut für Normung e. V. DIN EN 15643:2021-12, Sustainability of construction works
- Framework for assessment of buildings and civil engineering works 91.040.01. Beuth Verlag GmbH, Berlin 91.040.01



THANK YOU!



TUBUGHNA

"The Beach People"

